

**January through June 2022
Semiannual Progress Report**

Bayway Refinery Complex

Linden, New Jersey

Prepared For:

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List of Acronyms and Definitions

1H – January 1 through June 30
2H – July 1 through December 31
1Q – First Quarter
3Q – Third Quarter
4Q – Fourth Quarter
AASHTO – American Association of State Highway Officials
ACO – Administrative Consent Order
aka – Also known as
AOC – Area of Concern
BRC – Bayway Refinery Complex
BSP – Bioslurping
CD – Compact Disk
CEA – Classification Exception Area
cm/sec – Centimeters per second
COP - ConocoPhillips
CVOC – Chlorinated Volatile Organic Compound
DDR – Detailed Design Report
DGA – Dense Grade Aggregate
DLUR – Department of Land Use Regulation
ECP – Engineering Control Monitoring Plan
EDD – Electronic Data Deliverable
ERA – Ecological Risk Assessment
ESCP – East Side Chemical Plant
ESEN – East Side Equalization and Neutralization
ETS – East Transfer Station
ExxonMobil – ExxonMobil Environmental and Property Solutions Company
FDI – Final Design Investigation
FFSR – Focused Feasibility Study Report
FHA – Flood Hazard Area
Film – LNAPL with an apparent thickness of less than 0.01 feet

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GBT – Gasoline Blending Tankfield
GCT – Gasoline Component Tankfield
GP – General Permit
gpm – Gallons Per Minute
GWQC – Ground Water Quality Criteria
GWRAP – Ground Water Remedial Action Permit
GWRs – Ground Water Remediation Standard
HDPE – High-Density Polyethylene
IAOC – Investigative Area of Concern
ICAR – Interim Corrective Action Report
Infineum – Infineum USA LP
IRM – Interim Remedial Measure
IRM Work Plan – December 22, 1992, Non-Aqueous Phase Liquid IRM Work Plan
IRPL – Inter-Refinery Pipe Line
Landfarm – Landfarm Waste Management Area
LLDPE – Linear Low-Density Polyethylene
LNAPL – Light Non-Aqueous Phase Liquid
LNAPL Report – November 24, 2010, LNAPL Interim Remedial Measure Report
LSRP – Licensed Site Remediation Professional
MDL – Method Detection Limit
MNA – Monitored Natural Attenuation
MTSA – Maritime Transportation Security Act
N.J.A.C. – New Jersey Administrative Code
NJDEP – New Jersey Department of Environmental Protection
OMM – Operation, Maintenance, and Monitoring
PDI – Pre-Design Investigation
PSE&G – Public Service Electric and Gas
P66 – Phillips 66
RAR – Remedial Action Report
RARA – Remedial Action Report Addendum
RASR – Remedial Action Selection Report

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RAW/RAWP – Remedial Action Work Plan
RAWA – Remedial Action Work Plan Addendum
RCM – Reactive Core Mat
RCRA – Resource Conservation and Recovery Act
Road Map – Remediation Strategy Road Map, Revision 5
RRTF – Rahway River Tankfield
SAPR – Semiannual Progress Report
SLOU – Sludge Lagoon Operable Unit
SRP – Site Remediation Program
SRRA – Site Remediation Reform Act
SRS – NJDEP Soil Remediation Standards
SVOCs – Semi-Volatile Organic Compounds
SWPS – Salt Water Pump Station
SWQS – Surface Water Quality Standards
TAL – Target Analyte List
TBA – tert-Butyl alcohol
TCL – Target Compound List
TICs – Tentatively-Identified Compounds
TOSCO – The Oil Shale Corporation
USCG – United States Coast Guard
USEPA – United States Environmental Protection Agency
VOCs – Volatile Organic Compounds
WVB – Waterfront Valve Box
WWTP – Wastewater Treatment Plant
µg/L – Micrograms per Liter

EXECUTIVE SUMMARY

This Semiannual Progress Report (SAPR) has been prepared for the site-wide activities conducted at the Bayway Refinery Complex (BRC) in Linden, New Jersey, on behalf of ExxonMobil Environmental and Property Solutions Company (ExxonMobil) from January 1 through June 30 (1H), 2022. The ongoing remedial activities presented within this report are consistent with the strategic approaches outlined in the following documents:

- The applicable Remedial Action Work Plans (RAWs/RAWPs) and subsequent Remedial Action Work Plan Addendums (RAWAs);
- The December 22, 1992, *Non-Aqueous Phase Liquid Interim Remedial Measure (IRM) Work Plan* (IRM Work Plan) and subsequent addendums to the IRM Work Plan;
- The April 11, 2000, *IRM Status Report and Proposal for Modified Monitoring, Recovery, and Reporting* (2000 IRM Status Report);
- The November 24, 2010, *Light Non-Aqueous Phase Liquid (LNAPL) Interim Remedial Measure Report* (LNAPL Report); and
- The approved *Remediation Strategy Road Map, Revision 5 (Road Map) for the Bayway Refinery Complex*.

In addition to the requirements and strategic approaches in the documents listed above, this SAPR was prepared pursuant to the following:

- *Exxon Bayway Site Administrative Consent Order* (ACO) and subsequent amendments;
- *Technical Requirements for Site Remediation*, New Jersey Administrative Code (N.J.A.C.) 7:26E;
- New Jersey Department of Environmental Protection (NJDEP) Site Remediation Program (SRP) June 29, 2012, *LNAPL Initial Recovery and Interim Remedial Measures Technical Guidance, Version 1.2*;
- NJDEP's August 2005 Field Sampling Procedures Manual (last updated March 2022); and
- NJDEP's 2005 *Vapor Intrusion Guidance* (updated March 2013, January 2018, and May 2021).

The activities conducted in 1H 2022 were in compliance with the above documents (unless specifically stated in the appropriate section[s] of this report), and a summary of either the ongoing activities and/or proposed activities for the applicable Investigative Area of Concerns (IAOCs) are

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provided throughout this SAPR. Any modifications proposed for specific IAOCs where IRMs or remedial actions are conducted are included in the applicable section(s) of the SAPR. ExxonMobil continues to schedule monthly meetings with the NJDEP, the site owner/operator (Phillips 66 [P66]), Licensed Site Remediation Professional (LSRP), and/or the United States Environmental Protection Agency (USEPA) to provide a status update that includes the scheduled report submittals for the next three months, the ongoing and scheduled field activities, and previous submittals to the NJDEP for which ExxonMobil is awaiting responses. This allows all parties an opportunity to provide updates on the status and anticipated timeframes of their deliverables or responses.

1 INTRODUCTION AND OVERVIEW

This SAPR has been prepared to summarize and document the progress of the ongoing remedial activities conducted at the BRC during the 1H 2022 reporting period. Whereas the ACO specifies the submission of quarterly Progress Reports, the NJDEP approved a modified submission schedule (semiannual) in a letter dated March 20, 2013. Reports referenced herein have been reviewed, commented on, and/or approved in coordination with the LSRP and the NJDEP SRP.

Ground water exceedances of aluminum, chloride, iron, manganese, and sodium are not included in exceedance summaries because these metals are naturally occurring and represent background ground water conditions at the site. These analytes are included in the ground water analytical data tables, where applicable, for information purposes only. Laboratory analytical data is available upon request.

Ground water samples collected from the BRC are analyzed for various parameters including target compound list (TCL) volatile organic compounds (VOCs) and tert-Butyl alcohol (TBA), TCL semi-volatile organic compounds (SVOCs), and/or target analyte list (TAL) metals. Analytical data presented on figures in this report only includes analytes which exceeded their respective NJDEP Class II-A Ground Water Remediation Standards (GWRS) or applicable Surface Water Criteria in a specific IAOC during this reporting period with the exception of aluminum, chloride, iron, manganese, and sodium as described above. The NJDEP's July 2021 *Technical Guidance for the Attainment of Remediation Standards and Site-Specific Criteria* (Version 2.0) states "Rounding of single point compliance data is acceptable. Rounding should be conducted to the number of significant figures expressed in the applicable remediation standard." Analytical data presented in tables and on figures in this report has been rounded in accordance with this technical guidance document.

ExxonMobil proposed freshwater and saline water Surface Water Quality Standards (SWQS) for contaminants of concern (COCs) which do not currently have promulgated NJDEP SWQS in a correspondence dated October 21, 2021. The NJDEP approved the proposed SWQS in an electronic correspondence dated October 27, 2021. Ground water analytical results from IAOCs with hydraulic control systems adjacent to surface water bodies (IAOCs A8, A9, A10, A13, D3a/D4, E2/E3/E4/E5, and L) were compared to the NJDEP SWQS or Bayway-specific SWQS, as appropriate, in addition to the NJDEP Class II-A GWRS to evaluate the effectiveness of the hydraulic control systems.

Ground water sampling logs are provided electronically on a compact disk (CD) as an attachment to this report. These sampling logs are indexed by sampling program and are in alpha-numeric order by quarter. Confirmation emails of electronic data deliverables (EDD) submissions that were not available during the submission of the 2H 2021 SAPR are included in **Attachment A-1**.

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Analyzed constituents not detected in ground water are reported to the laboratory's method detection limit (MDL) and, per NJDEP guidance, are presented in the tables using the symbol "<" along with the constituent's associated laboratory MDL.

Surface water inspection frequencies associated with previously identified IRMs were reduced to align with the Road Map and current remedial actions, as appropriate. More frequent surface water inspections are completed during extended system down time (if applicable). Inspection sheets are maintained by ExxonMobil and are available upon request.

1.1 Report Organization

Introduction and Overview (Section 1) – This section includes the purpose and objectives of the report. Information associated with the Road Map and third-party incidents is also included in this section.

Site-Wide Regulatory Status (Section 2) – This section provides a summary of regulatory aspects pertinent to remediation at the BRC, but not specifically included in the IRM activities; remedial action construction, evaluation, and confirmation activities; or remedial action operation, maintenance, and monitoring (OMM) activities.

Interim Remedial Measures Monitoring Report (Section 3) – This section summarizes the remedial monitoring activities conducted at each of the BRC IRM areas, and an evaluation of LNAPL recovery efforts during the reporting period.

Remedial Action Construction, Evaluation and Confirmation Updates (Section 4) – This section summarizes the remedial action progress at areas of the BRC where implementation of NJDEP-approved RAWs/RAWPs are underway.

Remedial Action Operation, Maintenance, and Monitoring (Section 5) – This section summarizes the remedial action monitoring and system operation activities performed in areas of the BRC where a remediation system has been constructed and remedial action operations are ongoing. This section also summarizes the cap inspection monitoring programs conducted within the BRC, as well as Site-Wide Annual Monitoring and Sampling Programs.

1.2 Background

The BRC is an approximately 1,300-acre petroleum and chemical processing facility where operations commenced in 1909. The BRC consists of complex and varied infrastructure. The remediation of the facility is being conducted in areas where historical environmental impacts associated with ExxonMobil's activities during their ownership and operation have been identified. Additionally, the remediation is being conducted pursuant to the ACO entered into by the NJDEP and ExxonMobil on November 27, 1991, and per the approved Road Map. The ACO was amended on April 8, 1993, to include the Inter-Refinery Pipe Line (IRPL) with the BRC property when both were sold by Exxon to The Oil Shale Corporation (TOSCO). Based upon the April 15, 2015, NJDEP approval letter, the remedial investigation and remedial actions associated with the IRPL have been completed. A Second Amendment to the ACO was executed on November 29, 1994, when the Linden Landfill property was sold to the City of Linden.

TOSCO was bought by Phillips Petroleum in 2001, which subsequently merged with Conoco to form ConocoPhillips (COP) in 2002. In 2012, ownership of the BRC was transferred from COP to P66. Infineum USA LP (Infineum), which assumed the Exxon Chemical America's portion of the site in 2000, has retained the West Side Chemical Plant (less than 40 acres) of the BRC, and Public Service Electric & Gas (PSE&G) has retained a service road which passes through the southern portion of the site. There are also several leaseholders that currently have operations within the BRC, which include:

- Eastman Chemical, Chemours (formerly DuPont);
- Veolia North America (a division of Chemours);
- Linden VFT Holding, LLC leases two tracts of land within the East Side Chemical Plant (ESCP) as part of the Cogeneration Plant operations; and
- P66 Partners leases the active rail yard in the 40-Acre Tankfield (IAOC F1) and 40-Acre Undeveloped Property (IAOC F3), as well as Domestic Trade Terminal and Tankfield (IAOC A13).

ExxonMobil has been undertaking remedial activities at the BRC in accordance with the ACO since approximately 1991. As described in the February 1993 Site History Report for the BRC, the BRC was divided into Investigative Units (Units A through H) based on hydrogeologic conditions and historical operations (**Figure 1.2-1**). Each Investigative Unit was further divided into IAOCs based on operations and historical usage, as described in the October 2000 *Phase IB Remedial Investigation Report*. Locations of IRM or remedial action activities, as well as periodic inspections performed by ExxonMobil at the BRC are shown on **Figure 1.2-1**.

1.3 NJDEP Approval of the 2H 2021 SAPR

The 2H 2021 SAPR was submitted to the NJDEP on March 29, 2022. The 2H 2021 SAPR included the following proposed modifications to activities reported in the SAPRs:

- Section 3.2 – Light Non-Aqueous Phase Liquid (LNAPL) Recovery Evaluation
 - East Side Chemical Plant LNAPL Recovery:
 - Reduce the gauging frequency for monitoring well CMW-5 to monthly; and
 - Discontinue visual inspections of surface water in the East Side Equalization and Neutralization Basin.
 - Caverns Area LNAPL Recovery:
 - Reduce the gauging frequency for monitoring wells GMW-227, GMW-272, and GMW-774 to monthly.
 - Waterfront Area LNAPL Recovery:
 - Reduce the gauging frequency for monitoring wells GMW-237 and GMW-276 to quarterly.
- Section 4.2 – Investigative Area of Concern (IAOC) C3 (Eastern Waterfront Tankfield/Pier) and C5 (Steamer Dock); and Section 5.14 Site-Wide Annual Overburden Ground Water Sampling Program
 - Remove monitoring well 331-MW-2 from the site-wide annual overburden ground water sampling program as this well has been inaccessible since 2017 due to consistent flooding in the area.
- Section 4.3 – IAOC D3a (Current and Former Diesel Tankfield) and D4 (Tank 519 Creek Dredging Area)
 - Discontinue visual inspections of surface water of Morses Creek and Peach Orchard Creek/Freshwater Reservoir, except during extended period of system downtime.
- Section 4.4 – IAOC F1 (40-Acre Tankfield Bioslurping System) Interim Remedial Measures:
 - Reduce the gauging frequency to quarterly based on the LNAPL thicknesses over the last year.
- Section 5.1 – IAOC A8 (Gasoline Blending Tankfield)
 - Discontinue visual inspections of surface water of Morses Creek, except during extended period of system downtime.
- Section 5.2 – IAOC A9 (Conservation Area)
 - Discontinue visual inspections of surface water of Morses Creek, except during extended period of system downtime.

The NJDEP SRP case manager approved the 2H 2021 SAPR via electronic correspondence dated April 13, 2022 (**Appendix A**).

1.4 Remediation Strategy Road Map

The Road Map summarizes a decision framework developed between the NJDEP SRP and ExxonMobil to manage remedial activities within the BRC. The Road Map document became necessary as a result of changes in the applicable laws and NJDEP regulations and is complementary to and aligns with the ACO. Revision 5 of the Road Map was approved by the NJDEP on December 10, 2018.

Per the approval of the Road Map, updates to the Remediation Strategy Road Map Project Schedule and Remediation Strategy Road Map Matrix Table as well as the corresponding updates to Figures 1 and 2 will be included in the 2H 2022 SAPR.

1.5 Third Party Incidents

This section summarizes known third party incidents that have occurred during this reporting period that either have or may in the future affect ExxonMobil's environmental investigation and/or remediation at the BRC. Documentation of these incidents are summarized below. According to the property owner, leaks that are managed in accordance with their Discharge Prevention Containment and Countermeasures Plan (DPCC) are documented separately to the NJDEP.

- Based on a P66 Bayway Emergency Notification System (BENS) communication via the #300 radio on May 18, 2022, P66 Dispatch indicated there was a scrubber leak on Railroad Avenue across from the labs at the Wet Gas Scrubber Unit. Based on continued communication via the #300 radio, it was also noted that sewers are in the area of the release. The NJDEP was notified (NJDEP Case Tracking Number 22-05-18-1010-48) and P66 emergency cleanup was completed. ExxonMobil will continue to follow up with P66 regarding this release.
- Based on a P66 BENS communication via the #300 radio on June 8, 2022, P66 Dispatch indicated there was a fire on the elevated roadway of the New Jersey Turnpike (NJTP) which crosses over the onsite Railroad Avenue roadway. Based on P66 communication, fire water runoff was leaking onto Railroad Avenue from the NJTP during fire extinguishing operations. Based on P66 communication via the #300 radio, boom was deployed around the Railroad Avenue ditch and drains and sewers along Railroad Avenue to prevent potential runoff migration.

2 SITE-WIDE REGULATORY STATUS

Remediation at the BRC is being conducted pursuant to the ACO entered into by the NJDEP and ExxonMobil on November 27, 1991 (as well as subsequent ACO amendments) and per the Road Map (**Section 1.4**). The following subsections include a summary of regulatory aspects pertinent to remediation at the BRC.

The biennial public notice for continuing remedial activities at the BRC, inclusive of posted notification signs, was submitted to the Linden and Elizabeth Municipal Clerks and Health Departments, Union County Office of Environmental Health and the NJDEP Bureau of Case Assignment and Initial Notice Notification and Public Outreach on January 21, 2022.

2.1 Deed Notice

A deed notice was prepared to address exceedances of the applicable NJDEP Soil Remediation Standards (SRS) and to protect human health and the environment by restricting the approximately 1,230-acre P66-owned portion of the BRC to non-residential use. The deed notice was reviewed and approved by the LSRP, filed with Union County Municipal Clerk on December 18, 2019, and a recorded copy of the Deed Notice was received from Union County on January 2, 2020. The recorded Deed Notice was submitted to the NJDEP on January 21, 2020.

Because the BRC is an active refinery and is designated as a Maritime Transportation Security Act (MTSA) facility, it is required that certain security measures be maintained at all times. The security measures that pertain to the BRC include, but are not limited to, the following:

- A fence surrounding the facility;
- Access controls as approved by the MTSA Facility Security Plan; and
- Natural barriers (i.e., Arthur Kill, Morses Creek, reservoirs).

Therefore, consistent with the NJDEP's direction, the above-mentioned security measures, which restrict/deter non-site workers from entering the facility, were utilized as the engineering controls specified in the recorded Deed Notice and will subsequently be utilized in a Soil Remedial Action Permit (SRAP; additional details in **Section 2.3**), in lieu of the AOC specific controls (e.g., caps). Inspections of the security measures were completed by P66 in 1H 2022. ExxonMobil requested a summary of the inspections, but as of the date of this report, a summary has not been received. The summary of P66's 1H and 2H 2021, along with 1H 2022, inspections of the security measures will be provided to the LSRP when available and will be included in a future SAPR.

In terms of AOC specific controls, ExxonMobil and P66 have established an Engineering Control Plan (ECP) for the site. The ECP is intended to address the identification, management, and maintenance of the integrity of AOC specific controls that have been or will be installed at the BRC in the context of ExxonMobil's remediation activities, and procedures to ensure that the AOC specific control(s) are restored in kind if breached. Any breaches/modifications to the existing or future AOC specific controls are documented within subsequent sections.

A separate deed notice was prepared to address exceedances of the applicable NJDEP SRS and to protect human health and the environment by restricting the 16-acre PSE&G-owned portion of the BRC to non-residential use. The deed notice was reviewed and approved by the LSRP, filed with Union County Municipal Clerk on October 14, 2021, and a recorded copy of the Deed Notice was received from Union County on November 17, 2021. The recorded Deed Notice was submitted to the NJDEP on November 19, 2021.

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A Deed notice to address exceedances of the NJDEP SRS on the 35-acre portion of the BRC property owned by Infineum is currently being discussed with the property owner and is currently planned to be filed with Union County in 2023.

2.2 Classification Exception Area

A ground water classification exception area (CEA) has been established per the Road Map and as required by N.J.A.C. 7:26C-7.3 and N.J.A.C. 7:26E-4.9(a)7 to provide notice that ground water at the site contains COCs at concentrations exceeding the NJDEP GWRS.

As outlined in an electronic correspondence with the NJDEP dated April 23, 2012, instead of submitting a CEA for each IAOC, a site-wide ground water CEA was included with the *Supplemental Site-Wide Remedial Investigation Report* dated May 2014 for the entire BRC. The site-wide CEA was approved by the NJDEP on July 22, 2015, to address ground water that does not meet the NJDEP Class II-A GWRS or site-specific Class III-B Ground Water Quality Criteria (as applicable). An updated CEA was submitted to the NJDEP on June 4, 2020, with the initial Ground Water Remedial Action Permit (GWRAP) application. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the GWRAP application was submitted to the NJDEP by the LSRP on August 18, 2021. However, no response was received from the NJDEP regarding the updated CEA. The updated CEA is scheduled to be submitted as a separate deliverable to the NJDEP in 2H 2022.

2.3 Remedial Action Permit Status

A SRAP is required for soil remedial actions that include engineering and/or institutional controls that require long-term monitoring, maintenance, and evaluation pursuant to N.J.A.C. 7:26C-7. The SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. It is ExxonMobil's understanding that the NJDEP is working on additional technical guidance regarding Soil Remedial Action Permits at large operating facilities such as Bayway. ExxonMobil awaits such guidance.

A GWRAP is required for ground water remedial actions that include engineering and/or institutional controls that require CEA/Well Restriction Areas or long-term monitoring, maintenance, and evaluation of ground water pursuant to N.J.A.C. 7:26C-7. The initial GWRAP application (for ground water recovery systems that have shown hydraulic control by July 2019) was submitted to the NJDEP on June 4, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the GWRAP application was submitted to the NJDEP by the LSRP on August 18, 2021. However, no response was received from the NJDEP regarding the updated CEA. The updated CEA is scheduled to be submitted as a separate deliverable to the NJDEP in 2H 2022.

Revised SRAP and GWRAP applications will be submitted at a later date, pending additional consultations with the NJDEP. Once approved, details regarding OMM associated with these permits will be reported in **Section 5** of future SAPRs.

2.4 Current Pre-Design Investigation/Final Design Investigation Activities

Pre-design Investigation (PDI) or final design investigation (FDI) activities are either currently in progress or proposed to commence in the next six months in the following areas at the BRC:

- ESCP (IAOC A7a);
- Caverns Area (IAOC A17);
- Pitch Area (IAOC A18);
- Waterfront Area (IAOC C2);
- B-Series (IAOCs B1, B2 and B3) and No. 1 Dam Creek Dredgings Area (IAOC C4);
- Eastern Waterfront Tankfield and Pier (IAOC C3) and Steamer Dock (IAOC C5);
- Clean Fill Area (IAOC E1);
- 40-Acre Tankfield (IAOC F1) and Former 40-Acre Tankfield Separator (IAOC F2); and
- Bedrock Ground Water.

Updates on the progress and schedule of these PDI/FDI activities are provided during the monthly 3-month look ahead meetings between ExxonMobil, the NJDEP, LSRP, and/or the USEPA.

2.5 Current Ecological Activities

Ecological Risk Assessments (ERAs) are being conducted in the following IAOCs:

- Clean Fill Area (IAOC E1);
- Former Tank 319 Waterfront Landfill, Waterfront Area, and Eastern Waterfront Tankfield/Pier (IAOCs C1, C2, and C3, respectively); and
- Tank 336 Creek Dredging Area, Western Waterfront Tankfield, Tank 301 Creek Dredging, and No.1 Dam Creek Dredging Area (IAOCs B1, B2, B3, and C4, respectively).

Following the completion of the ERA activities, Ecological Risk Assessment Reports will be submitted to the NJDEP. Additionally, ExxonMobil and the NJDEP have held several meetings in response to the NJDEP's comments on the *Revised Ecological Risk Assessment Report, Ecological Exposure Zones (EEZs) 1, 2, 7, 8, 10, and 14*, dated March 26, 2019. A response to comments letter was submitted to the NJDEP on January 22, 2021. A *Morses Creek Feasibility Study Work Plan* is being prepared that will include plans to address the NJDEP comments.

2.6 Monthly Regulatory Meetings

ExxonMobil continues to schedule monthly meetings with the NJDEP, P66, LSRP, and the USEPA to provide a status update that includes the scheduled report submittals for the next three months, the ongoing and scheduled field activities, and previous submittals to the NJDEP for which ExxonMobil is awaiting responses. This allows all parties an opportunity to provide updates on the status and anticipated timeframes of the deliverables or responses.

3 INTERIM REMEDIAL MEASURES MONITORING

The purpose of the IRM monitoring program is to document and recover LNAPL in wells outside of hydraulically-controlled or actively-remediated areas to prevent potential migration into nearby or off-site water bodies.

IRM activities at the Waterfront Valve Box (WVB) including visual inspections and LNAPL recovery, as necessary, were conducted during 1H 2022 (**Section 3.1**). The WVB IRM activities are consistent with the NJDEP-approved *Supplemental Interim Remedial Measure Design* dated April 21, 2016.

An LNAPL recovery evaluation commenced in 2H 2020 for IAOCs without approved remedial actions. The need for continued LNAPL recovery at the individual wells was evaluated and the results and recommendations are included in **Section 3.2**.

3.1 Waterfront Valve Box

Program Requirements

- Monitor the upgradient collection/observation wells for LNAPL – Monthly.
- Monitor the AquaGate®+Organoclay filter structure for LNAPL – Monthly.
- Monitor Morses Creek for sheen – Monthly.
- Recover LNAPL – As necessary.

Program Requirements Met

- Monthly monitoring was completed as planned in January, February, March, and April 2022, and inspection sheets are available upon request. The May and June 2022 monitoring events could not be completed due to construction activities associated with the replacement of the adjacent Railroad Avenue Bridge that spans Morses Creek.

Interim Remedial Action Components

- An 8-foot long, 1-foot wide, 8-foot-deep observation trench was installed in September 2017 upgradient of the WVB filter structure. Two solid bottom 6-inch diameter observation wells (WVB-W01 and WVB-W02) were installed to the bottom of the trench (**Figure 3.1-1**).
- A new section of timber sheet pile wall was installed to extend the existing bulkhead across the WVB opening to Morses Creek (**Figure 3.1-1**). A Reactive Core Mat (RCM)TM with Organoclay® was installed to line the face of the timber sheeting, extending 18 inches against the existing bulkheads. The RCM creates a seal at the interface of the WVB barrier and filter structures and the existing bulkheads.
- A sorptive barrier and filter structure were installed within the extended bulkhead area. The filter structure is a 2-foot and 7-inch wide by 7-foot long by 6-foot-high aluminum box filled with AquaGate®+Organoclay to adsorb LNAPL. The area surrounding the AquaGate®+Organoclay filter structure within the newly extended bulkhead was filled with AquaBlok®, a low-permeability material (**Figure 3.1-1**). An observation sump is installed in the center of the filter structure.

Ground Water Monitoring Summary

- Monthly – Observation wells WVB-W01 and WVB-W02 (**Figure 3.1-1**). Measurable LNAPL was not detected in either observation well during the monthly ground water

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monitoring events completed in January through April 2022. The wells were inaccessible in May and June 2022 due to construction activities in the area associated with the bridge replacement.

LNAPL Recovery Summary

- Not applicable – Measurable LNAPL was not detected on surface water between the absorbent booms and the timber wall during the reporting period.

Surface Water Inspection

- Since the installation of the enhanced IRM, LNAPL recovery via vacuum truck has not been needed between the absorbent booms and the timber wall. Sheen observed on the surface water during visual inspections of the WVB is captured by absorbent booms (regardless of contributing factor or source) that are replaced, as necessary.

Recommendations and Path Forward

- Continue monthly inspections. Please note that construction of the bridge replacement is schedule for completion by August 31, 2022.
- Continue ground water monitoring in observation wells WVB-W01 and WVB-W02.
- LNAPL recovery via vacuum truck will be completed as needed based on visual observations during the monthly inspections. Since the installation of the enhanced IRM, LNAPL recovery via vacuum truck has not been necessary between the booms and the timber wall.

Program Supporting Documentation and Prior Approvals

- April 21, 2016, NJDEP approval of the *Waterfront Valve Box – Supplemental Interim Remedial Measure Design*.
- April 23, 2019, NJDEP approval of the 2H 2018 SAPR – Reduction of inspection frequency from weekly to monthly.

3.2 LNAPL Recovery Evaluation

Per the IRM Work Plan, LNAPL monitoring and recovery activities are to be utilized to prevent migration of LNAPL to surface water in areas that are not hydraulically controlled. Currently, LNAPL IRM activities including inspections, gauging, recovery via vacuum truck, and recovery using hydrophobic/oleophilic socks (absorbent socks) are conducted at three IAOCs as described in this section. LNAPL recovery is conducted via vacuum truck or absorbent socks in select monitoring wells in the ESCP (IAOC A7a), Caverns Area (IAOC A17), and Waterfront Area (IAOC C2). Absorbent socks are replaced, if necessary, based on the presence of either LNAPL in the well or amount of LNAPL absorbed by the socks. Additionally, monthly visual inspections are conducted at the Condenser Ditch in IAOC A7a.

Each IAOC is detailed below. This LNAPL recovery evaluation is conducted on a semiannual basis and reported in the SAPRs.

IAOC A7a – ESCP

Well locations and visual inspection areas are shown on **Figure 3.2-1**. Gauging data and the applicable LNAPL recovery frequencies for IAOC A7a are included in **Table 3.2-1**.

- Gauging (frequency is based on distance from a surface water body):
 - Every two weeks – Monitoring wells APZ-103, CMW-8, GMW-232, GMW-268, GMW-764, GMW-781, ESEN-MW-3, ESEN-MW-4, and ESEN-MW-5.
 - Monthly – Monitoring wells CMW-5, GMW-203, GMW-236 and ESEN-MW-1.
 - Results of the gauging indicates that LNAPL was not detected in any of the above wells since prior to the May 25, 2022, gauging event (last detection was in GMW-232 – 0.02 ft on May 11, 2002).
- Visual Inspections:
 - Condenser Ditch Visual Inspection (Monthly) – The area of the Condenser Ditch near monitoring wells GMW-268 and GMW-781 was visually inspected for the presence of a sheen. Small areas of sheen were noted intermittently along the channel during the visual inspection completed in May 2022. The surface water in the Condenser Ditch flows to the southeast toward the Railroad Avenue Ditch. There is a boom maintained by P66 at the outfall of the Condenser Ditch into the Railroad Avenue Ditch.

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- LNAPL Recovery Summary/Path Forward
 - Continue to monitor wells as outlined above. If gauging data indicates that 0.01 feet of measurable LNAPL is detected in the monitoring wells, the absorbent socks will be replaced.
 - Continue monthly visual inspections in the area of the Condenser Ditch near monitoring wells GMW-268 and GMW-781.

IAOC A17 – Caverns Area

Well locations are shown on **Figure 3.2-2**. Gauging data and the applicable LNAPL recovery frequencies for IAOC A17 are included in **Table 3.2-2**.

- Gauging (Monthly):
 - Newly installed monitoring wells/piezometers added to the program: Monitoring wells GMW-788, GMW-789, GMW-790; Piezometers APZ-124 and APZ-125.
 - Absorbent socks: APZ-112, APZ-113, APZ-124, GMW-229, GMW-272, GMW-769, and GMW-774.
 - Vac Truck Recovery (if needed): APZ-114, APZ-115, APZ-125, GMW-770, and GMW-790.
 - Gauge only (if LNAPL detected will be recovered via absorbent sock or vac truck): GMW-227, GMW-788, and GMW-789.
- Absorbent booms located at the northern and southern end of the Poly Ditch are inspected monthly and replaced, as needed.
- LNAPL Recovery Summary/Path Forward
 - Continue to monitor the wells as outlined above. If gauging data indicates that 0.1 feet or more of measurable LNAPL is detected in the monitoring wells, the absorbent socks will be replaced after recovering LNAPL via vacuum truck.

IAOC C2 – Waterfront Area

Well locations are shown on **Figure 3.2-3**. Gauging data and the applicable LNAPL recovery frequencies for IAOC C2 are included in **Table 3.2-3**.

- Quarterly gauging – Monitoring wells GMW-237 and GMW-276. Absorbent socks are installed in these wells. LNAPL was not detected in these wells during this reporting period.

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- Monthly gauging – Monitoring well GMW-791. GMW-791 was installed in May 2022 as part of continued investigation activities at the southern portion of IAOC C2. Measurable LNAPL (0.02 ft) was detected two weeks after installation. An absorbent sock was installed on June 7, 2022. Additional investigation activities are scheduled for this area of the site and will be reported in a separate deliverable to the NJDEP.
- LNAPL Recovery Summary/Path Forward
 - The hydraulic control system has been installed in IAOCs C1/C2 and system start-up testing activities are being conducted. Once full system operation is complete, IRM activities will be discontinued for this area of the site. Until that time, the monitoring wells as outlined above will continue to be gauged on the applicable frequency.

4 REMEDIAL ACTION CONSTRUCTION, EVALUATION, AND CONFIRMATION

This section summarizes the status of the remedial action construction, evaluation, and confirmation activities ExxonMobil is currently undertaking at the BRC. The areas with remedial action construction, evaluation, and confirmation activities currently in progress include:

- IAOCs C1 and C2 – Former Tank 319 Waterfront Landfill and Waterfront Area, respectively (**Section 4.1**);
- IAOCs C3 and C5 – Former Waterfront Tankfield/Pier and Steamer Dock, respectively (**Section 4.2**);
- IAOC D3a and D4 – Current and Former Diesel Tankfield and Tank 519 Creek Dredging Area, respectively (**Section 4.3**); and
- IAOC F1 – 40-Acre Tankfield (**Section 4.4**).

4.1 IAOC C1 - Former Tank 319 Waterfront Landfill Area and IAOC C2 - Waterfront Area

The Former Tank 319 Waterfront Landfill Area (IAOC C1) and Waterfront Area (IAOC C2) are in the southeastern portion of the BRC. IAOC C1 is a 20-acre parcel, the central portion of which was used as a landfill for trash and refinery wastes from 1950 to 1960. The area is bordered to the northeast by Morses Creek. IAOC C2 is a 12-acre area bordered to the east by the Arthur Kill. The northern portion of IAOC C2 is currently being used as a contractor laydown area by P66, and the southern portion is undeveloped and contains historically deposited fill material.

An Overburden Ground Water RAW for IAOCs C1 and C2 was submitted to the NJDEP on February 28, 2017, and approved on May 2, 2017. An Overburden Ground Water RAW Addendum (RAWA) for IAOC C2 was submitted to the NJDEP on December 8, 2021. The RAWA proposed modifications to the IAOC C2 barrier wall and recovery well system that were necessitated by the identification of three subsurface pipeline easements that cross IAOC C2 and preclude the installation of a portion of the subsurface barrier wall and certain recovery wells as originally proposed. A response to the IAOC C2 RAWA was received from the NJDEP on March 10, 2022, and a Revised RAWA is anticipated for submittal in 2H 2022.

A Soil RAW for IAOC C1 was submitted to the NJDEP on July 19, 2019, and approved on February 11, 2020. An ERA is ongoing for portions of IAOC C1 (outside of the landfill area) and IAOC C2. An ERA Report and a Revised Focused Feasibility Study Report / Soil Remedial Action Workplan (RFFSR/SRAW) for IAOC C2 are scheduled to be submitted to the NJDEP in 2H 2022. An ERA Report for IAOC C1 is scheduled to be submitted to the NJDEP in 2023.

The specific remedial action components and status of the remedial action construction are summarized below.

Remedial Action Components

- Institutional control (Deed Notice) for the entire IAOC C1/C2 area to restrict use to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019.
- Steel sheet pile barrier walls installed along the area of IAOC C1 bordering Morses Creek and along the area of IAOC C2 bordering the Arthur Kill for ground water and LNAPL containment.
- A ground water and LNAPL recovery system is to be operated inland of the barrier walls and along the downgradient IAOC boundaries to maintain hydraulic control across the entire IAOC C1/C2 area.
- A final soil cover and capping system is to be installed to close the former IAOC C1 landfill unit in accordance with applicable regulatory requirements and to address concentrations

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of COCs in soil above the NJDEP Non-Residential Direct Contact Soil Remediation Standards.

Status at the End of the Reporting Period

- Installation of the sheet pile barrier wall is complete in IAOC C1 and nearly complete in IAOC C2. Access was received in 2Q2022 from the owner of one of the pipeline easements in IAOC C2 that will allow additional sheet piles to be driven within the easement, thereby narrowing the gap required around the subsurface pipeline. Coordination of the pile driving activities is ongoing as of the date of this report.
- The 12 hydraulic control system recovery wells in IAOC C1 are installed, and 11 recovery wells have been installed within IAOC C2. Additional recovery wells are anticipated for installation within IAOC C2 in the areas of the pipeline easements, the details of which will be included within the Revised RAWA to be submitted at a later date.
- Installation of the proposed hydraulic control system performance monitoring wells in IAOCs C1 and C2 is complete, and former ground water monitoring well GMW-26 and recovery wells RW-C1, RW-C2, RW-C3, RW-C4, and RW-C5 were properly abandoned.
- Trenching and piping installation activities are generally complete in IAOCs C1 and C2. Temporary piping is currently in place for a road crossing between the IAOC C1 piping network and the system equipment container location in IAOC C3. Installation of the final piping will occur upon completion of onsite construction activities by the property owner which will allow for closure of the roadway (anticipated for 2H 2022). Piping modifications will also be required in IAOC C2 to facilitate connection of additional recovery wells that will be installed near pipeline easements.
- Construction of the remedial equipment and electrical component area, the system electrical conduit, and the discharge piping is complete. Start-up testing and operation of the remedial system equipment was performed in early July 2022. Additional details will be provided in the 2H 2022 SAPR.
- Vegetation clearing within the IAOC C1 landfill limits is complete, and grading activities and the import of subgrade, cover soil, and topsoil materials is ongoing. The design for the landfill cover system includes a surcharge area on the eastern portion of IAOC C1 that requires settlement monitoring. The final import and compaction of surcharge material in this area was completed during this reporting period. Construction of the final cover system will not commence until settling rates have subsided, which is anticipated to occur in 2023. As such, much of the IAOC C1 soil remedial action construction activities have been suspended while the settlement monitoring is ongoing. Temporary seeding of the landfill area was completed once the earthwork activities were suspended.

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- Restoration activities including placement of topsoil, seeding, planting of trees and shrubs, and installation of deer fence for disturbances associated with the IAOC C1 ground water remedial action are complete. These restoration areas are outside of the limits of the former landfill unit. Watering and vegetation management activities are ongoing.
- Permitting for the IAOCs C1 and C2 ground water remedial actions and the IAOC C1 soil remedial action is complete.
- The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County.
- The NJDEP provided comments on the IAOC C2 Overburden Ground Water RAWA in a letter dated March 10, 2022. A response to comments will be provided in a future submittal.

Remedial Actions to be Completed in the Next Reporting Period

- Continue construction and hydraulic control system start-up activities.

Permits

- NJPDES Individual Construction Activity Stormwater Permit No. NJ0297755 (IAOC C1 ground water and soil remedial actions).
- NJPDES Construction Activity Stormwater 5G3 General Permit No. NJG0317446 (IAOC C2 ground water remedial action).
- Somerset-Union Soil Conservation District Soil Erosion and Sediment Control Plan Approval Nos. 2018-3391 (IAOC C1 ground water remedial actions), 2020-4115 (IAOC C2 ground water remedial actions), and 2019-3872 (IAOC C1 soil remedial actions).
- NJDEP Division of Solid & Hazardous Waste Modified Sanitary Landfill Closure Plan Approval No. LCB220001 (IAOC C1 ground water and soil remedial actions).
- U.S. Army Corps of Engineers Nationwide General Permit No. 38 for the Cleanup of Hazardous and Toxic Waste, File Number NAN-2018-01255-ESW (IAOCs C1 and C2 ground water remedial actions).
- Approved NJDEP DLUR permits for the IAOC C1 ground water remedial actions under file No. 2009-14-0002.10: Flood Hazard Area (FHA) Individual Permit (FHA190001), Flood Hazard Verification (FHA190002), Freshwater Wetlands General Permit (GP) #4 – Hazardous Site Investigation and Cleanup (FWW190001), and Freshwater Wetlands GP #5 – Landfill Closures (FWW190002).

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- Approved NJDEP DLUR permits for the IAOC C2 ground water remedial actions under file No. 2009-14-0002.11 LUP190001: FHA Individual Permit, Freshwater Wetlands GP #4 – Hazardous Site Investigation and Cleanup, and Coastal Zone Management GP #11 – Hazardous Site Investigation and Cleanup.
- Approved NJDEP DLUR permits for the IAOC C1 soil remedial actions under file No. 2009-14-0002.12 LUP200001: FHA Individual Permit, Freshwater Wetlands GP #4 – Hazardous Site Investigation and Cleanup, Freshwater Wetlands GP #5 – Landfill Closures, and Freshwater Wetlands GP #11 – Outfalls and Intake Structures.
- City of Linden Site Plan Approval No. SP-1102-2019 (IAOC C1 soil remedial actions).
- Consolidated Rail Corporation License Agreement (IAOC C1 ground water remedial actions).
- NJDEP Water Allocation Permit No. 2633P.

Program-Supporting Documentation and Prior Approvals

- The March 2017 *IAOC C1/C2 Overburden Ground Water RAW* and response to NJDEP comments, approved by the NJDEP on May 2, 2017.
- The July 2019 *IAOC C1 Soil RAW*, approved by the NJDEP on February 11, 2020.
- The July 2019 *IAOC C2 Waterfront Area Remedial Action Approach*, approved by the NJDEP on December 2, 2019.
- The December 18, 2019, filing and recording of the Deed Notice for the P66-owned portion of the BRC with Union County.
- The *IAOC C2 Overburden Ground Water RAWA* was submitted to the NJDEP in December 2021. The NJDEP provided comments on this report in a letter dated March 10, 2022. A response to comments will be provided in a future submittal.

4.2 IAOC C3 - Eastern Waterfront Tankfield/Pier and IAOC C5 - Steamer Dock

The Eastern Waterfront Tankfield/Pier (IAOC C3) and Steamer Dock (IAOC C5) are located in the C-Unit Waterfront Area and occupy approximately 62 acres along the eastern portion of the BRC, bordering the Arthur Kill. IAOC C3 is a predominantly active area of the BRC with the Pier being used for off-loading crude oil to the BRC and for loading petroleum products into shipping vessels for distribution. Portions of IAOC C5 are considered active areas of the BRC with the Steamer Docks being utilized as the docking and receiving facilities for various grades of petroleum that arrive by tanker. IAOCs C3 and C5 were formerly being managed as IRMs; however, with LSRP approval, the remedial actions presented in the RAW are being implemented within IAOCs C3 and C5 and are consistent with the strategic approach outlined in the Road Map and therefore the activities conducted were moved from the IRM section of the SAPR (**Section 3**) to the remedial action construction, evaluation, and confirmation activities (**Section 4**).

Remedial Action Components

- Institutional control (Deed Notice) for the entire C-Unit Waterfront Area, including IAOCs C3 and C5, restrict this area to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019.
- LNAPL recovery via absorbent socks in monitoring wells WBP-MW-7, WBP-MW-11, WBP-MW-11R, GMW-653, GMW-654, GMW-785, and WBP-MW-A1; and in WBP-MW-10 via peristaltic pump.
- Monitored natural attenuation (MNA) addresses dissolved-phase COCs in ground water that exceed their respective NJDEP GWRS. The C3/C5 sampling program was updated in 2020 based on the NJDEP-approved 2020 Site Wide Annual Overburden Ground Water Sampling Program.

Remedial Actions Completed During the Reporting Period

- Recovery of LNAPL via absorbent socks. The LNAPL recovery locations are shown on **Figure 4.2-1**.
- MNA ground water sampling was completed in conjunction with the site-wide annual overburden ground water sampling program.
- Visual inspections at the Sound Shore Manifold (also known as [aka] Snake Pit), located in the Waterfront Area (see **Figure 1.2-1**), are conducted monthly to determine whether sheens, films (LNAPL with apparent thickness less than 0.01 feet), and/or seeps are present. During the time of inspection, in February and April, a sheen was observed on

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the surface of Morses Creek between the timber bulkhead and the absorbent boom. Sheen was not observed outside of the absorbent boom on Morses Creek.

- If present during visual inspections of the Sound Shore Manifold (aka Snake Pit), sheens on the surface water bodies are captured by absorbent booms (regardless of contributing factor or source) that are replaced as necessary. Visual inspection sheets are maintained by ExxonMobil and are available upon request.

Ground Water Monitoring Summary

- Quarterly ground water monitoring event – As per the 2017 C3/C5 Soil and Ground Water RAW, quarterly gauging was completed for two consecutive quarters. Because LNAPL was not detected, the wells in IAOC C3/C5 that are not a part of the LNAPL recovery program were added back to the site-wide annual gauging program and will be included in the 2H 2022 SAPR.
- Ground water monitoring of monitoring wells with absorbent socks (WBP-MW-7, WBP-W-11, WBP-MW-11R, GMW-653, GMW-654, GMW-785, and WBP-MW-A1) monthly (**Table 4.2-1**).
- Weekly ground water monitoring of monitoring well WBP-MW-10 with LNAPL removed via peristaltic pump per the 2017 C3/C5 Soil and Ground Water RAW (**Table 4.2-1**).
- LNAPL – During this reporting period, detections ranged from a film in monitoring wells GMW-653, GMW-785, and WBP-MW-A1 and measurable LNAPL (thickness between 0.01 and 0.59 feet) in GMW-654, WBP-MW-10 and WBP-MW-11. These detections are consistent with historical LNAPL thicknesses in this area of the BRC.

LNAPL Recovery

- LNAPL recovery via absorbent socks – Monthly at monitoring wells GMW-653, GMW-654, WBP-MW-7, WBP-MW-11, WBP-MW-11R, and WBP-MW-A1. Absorbent socks deployed in wells with measurable thicknesses of LNAPL are removed from monitoring wells and weighed to estimate the amount of LNAPL recovered in gallons. The estimated volume of LNAPL recovered via absorbent socks is shown in **Table 4.2-2**. GMW-785 is gauged only. If LNAPL is detected, an absorbent sock will be installed in the well.
- LNAPL recovery via peristaltic pump – Weekly at monitoring well WBP-MW-10. Due to limited LNAPL recovery in the passive bailer in WBP-MW-10, the bailer was removed on August 10, 2020, and weekly LNAPL recovery via a peristaltic pump was initiated. The estimated volume of LNAPL recovered via a peristaltic pump is shown in **Table 4.2-2**.

Ground Water Analytical Results Summary

- The annual ground water sampling event was completed between June 1 through 20, 2022. Because the annual ground water sampling is conducted as part of the site-wide annual overburden ground water sampling program, the analytical results will be included in the 2H 2022 SAPR.
- The Proposed Alternative, Site-Specific Ground Water Quality Criteria (GWQC) for select analytes for the Class III-B aquifer (May 2001) was approved conditionally by the NJDEP and will be used for evaluating ground water in IAOCs C3 and C5. COCs with Class III-B standards include, but are not limited to, benzene and lead. ExxonMobil is currently in the process of proposing Class III-B standards for the remaining COCs in the Class III-B aquifer at the BRC.

Remedial Action Performance

- LNAPL has not been detected at thicknesses greater than 0.01 feet in monitoring wells with absorbent socks since October 18, 2019, except for WBP-MW-11 on March 18, 2020 (as reported in the 1H 2020 SAPR) and October 19, November 15, and December 16, 2021 (as reported in the 2H 2021 SAPR), indicating that the use of absorbent socks is effective in recovering LNAPL in these wells.

Hazardous Waste Management

- One drum of water and LNAPL from the C3/C5 LNAPL recovery program was transported offsite for disposal on March 2, 2022. The non-hazardous waste disposal manifest is included in **Appendix B**.

Status at the End of the Reporting Period

- An institutional control (Deed Notice) for the entire C-Unit Waterfront Area, including IAOCs C3 and C5 restricts this area to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019, and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.
- Ground water sampling will continue to be conducted annually as part of the site-wide annual overburden ground water sampling program.

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Remedial Actions Scheduled to be Completed in the Next Reporting Period

- Continue to implement the LNAPL recovery activities proposed in the 2017 IAOCs C3/C5 Soil and Ground Water RAW.
- Continue weekly gauging of WBP-MW-10 and recover LNAPL via a peristaltic pump.
- Continue monthly gauging of monitoring wells with absorbent socks (GMW-653, GMW-654, WBP-MW-7, WBP-MW-11, WBP-MW-11R, and WBP-MW-A1) and GMW-785.
- Additional PDI activities are planned for select areas of IAOC C3/C5 and the results will be presented in a RAWA.

Permits

- Not applicable.

Program Supporting Documentation and Prior Approvals

- 2000 *IRM Status Report and Proposal for Modified Monitoring, Recovery, and Reporting* which included IAOC C3.
- 2010 LNAPL Report which included IAOC C3.
- November 30, 2012, NJDEP approval of the *Salt Water Pump Station (SWPS) IRM (IAOC C5) Work Plan*.
- April 10, 2014, NJDEP approval of the 2H 2013 SAPR – Established visual inspections of the north building for the presence of seeps (IAOC C5).
- April 26, 2016, NJDEP approval of the 2H 2015 SAPR – Approved the permanent shutdown of the total fluids recovery system at SUMP P-403, located in the Waterfront Barge Pier IRM (IAOC C3), which was permanently placed offline after a yearlong pilot test.
- July 5, 2017, NJDEP approval of the 2H 2016 SAPR – Reduced monitoring frequency from monthly to quarterly in accordance with the November 2012 IRM Work Plan SWPS (IAOC C5).
- February 27, 2018, LSRP approval of the *C3/C5 LNAPL Remedial Action* – Approved the implementation of LNAPL recovery via a passive bailer or absorbent socks in select monitoring wells.

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- June 25, 2019, LSRP approval to eliminate implementation of the SWPS IRM and subsequently implement proposed LNAPL monitoring and recovery activities presented in the C3/C5 Soil and Ground Water RAW.
- June 26, 2019, LSRP approval to eliminate surface water inspections of the Arthur Kill and SWPS north building.
- December 18, 2019, filing and recording of the Deed Notice for the P66-owned portion of the BRC with Union County.
- December 8, 2020, NJDEP approval of the 1H 2020 SAPR and *Support and Clarification of Recommended Actions* document which stated that quarterly gauging events were eliminated following the first quarter (1Q) 2020 event based on the results of quarterly gauging in 2019 and 2020.
- November 8, 2021, NJDEP approval of the 1H 2021 SAPR which proposed a reduction of gauging frequency for monitoring wells with absorbent socks (GMW-653, GMW-654, WBP-MW-7, WBP-MW-11, WBP-MW-11R, and WBP-MW-A1) to monthly.
- April 13, 2022, NJDEP approval of the 2H 2021 SAPR which proposed the removal of 331-MW-2 from the annual ground water sampling event.

4.3 IAOC D3a - Current and Former Diesel Tankfield and IAOC D4 - Tank 519 Creek Dredging Area

The Current and Former Diesel Tankfield (IAOC D3a) is an active area located in the southern portion of the BRC adjacent to West Brook Reservoir and Peach Orchard Creek Reservoir (collectively the Freshwater Reservoir), and Morses Creek. A portion of IAOC D3a is occupied by the Former Tank 510 Soil and Ground Water Remediation treatment area; an electrical control box; a maintenance building; trailers; equipment; vehicles; a parking lot; storage sheds; a stockpile area; access roads; active tankfields; pipe racks; and above and below ground piping/utilities.

The Tank 519 Creek Dredging Area (IAOC D4) is a bermed area located adjacent to IAOC D3a and IAOC D3b that is used by P66 for storage of storm water overflow. Above grade utility structures (manhole, electrical control box, storm water discharge piping, storm water inlet, and pipe racks) and underground utilities are present in this area.

A RAW for IAOCs D3a and D4 was submitted to the NJDEP on November 15, 2011. A RAWA for IAOCs D3a and D4 was submitted to the NJDEP on May 2, 2012. The NJDEP approved the RAW and RAWA on May 31, 2012. The specific remedial action components and status of the remedial action construction are summarized below.

Remedial Action Components – Ground Water

- Hydraulic barrier wall – The barrier wall is constructed of approximately 2,700 total linear feet of steel sheet pile wall keyed into glacial till. There are 12 sections of barrier wall, with gaps of varying width between the sections where utility crossings and refinery infrastructure prevented the installation of a continuous barrier wall. The southernmost portion of the barrier wall (approximately 400 linear feet) was installed in conjunction with earlier remedial efforts for the Former Tank 510 Area (**Figure 4.3-1**), while the remaining approximately 2,300 linear feet of wall was installed between 2016 and 2017 as part of the final remedial action for IAOCs D3a and D4.
- Hydraulic control system – The system for IAOCs D3a and D4 (Diesel system) consists of pneumatic pumps operated within a network of 32 recovery wells (23 below-grade wells located within vaults and 9 above-grade wells in areas where localized surface water inundation commonly occurs) located inland of the barrier wall and near gaps within or at the ends of the barrier wall sections. Recovered total fluids are processed through an oil/water separator prior to the recovered ground water being discharged to the P66 WWTP via the Sludge Lagoon Operable Unit (SLOU) Force Main. Recovered LNAPL is transported to the P66 WWTP via vacuum truck.

Remedial Actions Completed During the Reporting Period

- The hydraulic control system was operational during the reporting period, with notable periods of downtime as detailed in the Remedial Action Performance section.
- Quarterly ground water monitoring was conducted.
- LNAPL monitoring and recovery activities were conducted.
- Quarterly ground water sampling was conducted.
- Interim visual inspections of surface water were completed during periods of extended system downtime.

Ground Water Monitoring Summary

- Quarterly ground water monitoring events were completed on February 10 and July 7, 2022 (**Table 4.3-1**, and **Figures 4.3-1** and **4.3-2**). Select wells in adjacent IAOCs were monitored in conjunction with those in IAOCs D3a and D4, and were used to determine ground water elevations, contours, and flow directions. The ground water monitoring data from these wells is included in **Table 4.3-1** and on **Figures 4.3-1** and **4.3-2**.
- The 2Q gauging event was originally planned for completion concurrent with the Four Landfill Area (IAOCs E2/E3/E4/E5) gauging event; however, integrity issues identified in the Diesel system influent pipeline required a temporary system shutdown which resulted in the delay of the 2Q event until July 7, 2022. During the 1Q event, monitoring well GMW-148 was inaccessible due to localized flooding and monitoring well GMW-286 was not gauged because of damage to the above-grade portion of the well casing. Monitoring well GMW-286 was repaired during the reporting period and both wells were gauged during the 2Q event.
- LNAPL detections during the quarterly monitoring events ranged from a film in several wells to an apparent thickness of 0.92 feet in monitoring well MW519-1 (1Q) (**Table 4.3-1**) and were generally consistent with historical data. The LNAPL detections were in wells or monitoring points located inland of the barrier walls and/or within the capture zone of the system.
- Supplemental gauging was completed in 1H 2022 for monitoring wells MW519-8 and MW519-11, piezometers DPZ-100 through DPZ-102, and recovery wells RW-510-1, RW-D3a-9, RW-D3a-11, RW-D3a-12, RW-D3a-14, RW-D3a-18, RW-D3a-19, RW-D3a-23, and RW-D3a-25, as summarized in **Table 4.3-2**. There were two primary drivers for the supplemental gauging performed during this reporting period: (1) The ongoing evaluation of the LNAPL observed in the wells following a release caused by flooding from the

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remnants of Hurricane Ida as detailed in the 2H 2021 SAPR, and (2) periods of extended system or recovery well downtime associated with system maintenance as detailed below. These wells were identified for supplemental gauging based on historical LNAPL detections and their locations near either the ends or gaps in the barrier wall. The gauging data collected during each event was used to determine the need for supplemental LNAPL recovery activities (refer to the LNAPL Recovery section that follows).

- LNAPL detections during the supplemental gauging events ranged from a film in several wells to an apparent thickness of 0.62 feet in MW519-8.

Ground Water Analytical Results Summary

- The 1Q ground water and system sampling event was conducted between February 10 through March 3, 2022. The 2Q ground water and system sampling event was conducted between May 11 through June 7, 2022 (**Tables 4.3-3** through **4.3-5** and **Figure 4.3-3**).
- Monitoring wells GMW-288, GMW-677, GMW-33, and GMW-33-20 were not sampled due to measurable LNAPL during 1Q and 2Q. This is consistent with historical conditions in these wells. Monitoring well MW519-3 was not sampled due to measurable LNAPL detected during 1Q, which is not consistent with historical conditions. An absorbent sock was used to recover LNAPL from MW519-13. LNAPL was not detected in MW519-3 during 2Q. Additional investigation to the possible sources of this LNAPL is ongoing. Monitoring well GMW-286 was not sampled during 1Q due to damage to the well. GMW-286 was repaired on April 29, 2022, and this well was sampled during the 2Q sampling event. MW-519-11 and MW-519-12 contained 1-inch diameter gauging port well heads which limited the ability to effectively sample the monitoring wells. The well heads were converted to 6-inch diameter (size of the monitoring wells) in 2Q. MW-519-11 was not sampled in 1Q but was sampled in 2Q while MW-519-12 was not sampled during either event (MW-519-3 was sampled instead during 2Q).
- COCs detected at concentrations above the NJDEP Class II-A GWRS during the 1Q and/or 2Q ground water and system sampling events include, benzene, benzo(a)pyrene, TBA, trichloroethene, vinyl chloride, VOC TICs, 2-methylnaphthalene, antimony, arsenic, chromium, and lead. The exceedances are consistent with historical results. Trichloroethene and vinyl chloride remain above the NJDEP Class II-A GWRS (but below the applicable Surface Water Quality Standards) in 510-P-2 located on the outside of the hydraulic barrier wall. The applicable Surface Water Quality Standards (Fresh or Saline) are shown on **Figure 4.3-3**. These were added as part of a continuing evaluation of the effectiveness of the hydraulic control system that will be included in a future report. No surface water samples were collected.

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- Ground water sampling logs and confirmation emails of EDD submissions are provided electronically on the attached CD (**Attachment A-2**).

LNAPL Recovery

- As detailed previously, supplemental gauging events were conducted at select wells during the reporting period to assess the need for interim LNAPL recovery events, particularly during periods of extended system or recovery well downtime. Based on the gauging results, recovery events using a vacuum truck were performed at piezometer DPZ-100 (once) and monitoring well MW519-8 (three times) during the reporting period, and absorbent socks were installed and maintained within piezometers DPZ-100 and DPZ-102, as summarized in **Table 4.3-2**.
- Wells in IAOCs D3a and D4 will continue to be monitored during routine quarterly gauging events, with LNAPL recovery events completed on an as-needed basis in accordance with the Road Map.

Remedial Action Performance

- The overall hydraulic control system runtime was approximately 86.5% during the reporting period. One notable period of downtime affecting the entire system occurred between March 29 and April 13, 2022. Recovery wells RW-510-1 through RW-510-4 and RW-D3a-1 through RW-D3a-23, which connect to the system container through a single piping main, were also offline for portions of the reporting period. These downtime events are presented in further detail below. Additional downtime during the period consisted of multiple short-duration shutdowns for routine maintenance and alarm activations, most of which were less than 24 hours in duration.
 - The entire system was shut down on March 29, 2022, to facilitate preventative maintenance activities that included mechanical cleaning of an above-grade portion of the system influent pipelines. During the event, an integrity issue was identified with the piping main that conveys fluids recovered from wells RW-510-1 through RW-510-4 and RW-D3a-1 through RW-D3a-23 to the system container. On April 13, 2022, system operations resumed with only recovery wells RW-D3a-25 through RW-D3a-29 online, which connect to the system container through a separate piping main.
 - Recovery wells RW-510-1 through RW-510-4 and RW-D3a-1 through RW-D3a-23 remained offline from the start of the system maintenance event on March 29, 2022, through May 23, 2022. During this downtime, a portion of the influent piping main connected to the wells was replaced. Recovery from the wells resumed on May 23, 2022; however, an additional integrity issue with the piping was identified on June 1, 2022, that required the wells be shut down again while another section of the piping main was replaced. Recovery from the wells resumed again on June 15, 2022. Taking

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into account these two periods of additional downtime for recovery wells RW-510-1 through RW-510-4 and RW-D3a-1 through RW-D3a-23, the approximate runtime for these select wells was 57% during the reporting period. Supplemental gauging and LNAPL recovery events were performed while the wells were offline, as detailed in the preceding Ground Water Monitoring Summary and LNAPL Recovery sections.

- Based on discharge totalizer readings, approximately 3,348,310 gallons of total fluids were recovered during the reporting period and discharged to the P66 WWTP. The system flow rate averaged approximately 14.8 gallons per minute (gpm) during operation.
- All 32 of the system recovery wells were operational during the reporting period; however, routine inspections throughout the period identified select pumps that required maintenance to address typical fouling issues, resulting in limited-duration downtime of individual recovery pumps.
- Ground water elevation contours for the 1Q (**Figure 4.3-1**) and 2Q (**Figure 4.3-2**) events confirm that hydraulic control was achieved at the ends of the wall and at the wall gaps.
- The bottom-loading pump operated in recovery well RW-510-2 was replaced with a top-loading pneumatic pump on June 13, 2022. Recovery well RW-510-2 is located near the southern end of the hydraulic barrier wall, and the change to a top-loading pump is expected to better address the LNAPL that has been detected in the vicinity of this well. LNAPL was not detected in recovery well RW-510-2 during the 2Q gauging event (**Table 4.3-1**), which was the first gauging event completed subsequent to the pump replacement.

Surface Water Inspections

- Interim surface water inspections along the Freshwater Reservoir (weekly or every two weeks, depending on how long the system was offline) were completed in April, May, and June, while the hydraulic control system was offline for discharge pipeline investigation and repairs. Sheen was not observed on the surface water from the bank side of the wall during the weekly interim inspections. Interim surface water inspection sheets are maintained by ExxonMobil and are available upon request.
- On September 8, 2021, P66 informed ExxonMobil via email that due to effects from the post-tropical cyclone (remnants of Hurricane Ida), the API Separator overflowed on September 1, 2021, and September 2, 2021, releasing wastewater containing slop oil into the onsite reservoirs and that the oil produced a sheen in and along the banks of Moses Creek, with some passing over Dam 1 into the Arthur Kill. The NJDEP was notified of this incident multiple times (NJDEP Case Tracking Numbers 21-09-01-2257-01, 21-09-02-0900-30, and 21-09-02-1746-02), along with the United States Coast Guard (USCG) and subsequent emergency cleanup activities commenced. ExxonMobil will continue to monitor these areas during routine system sampling and gauging events and discuss any

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change in conditions with P66 and the LSRP. Refer to **Section 1.5** for additional information.

- If a sheen is present on the surface water bodies, they are captured by absorbent booms deployed by P66 (regardless of contributing factor or source). The P66-maintained boom is outside the scope of ExxonMobil's activities.

Status at the End of the Reporting Period

- The system is fully operational and recovery pump performance continues to be monitored with maintenance performed on an as-needed basis.
- Integrity concerns attributed to corrosion of the Diesel system's carbon steel pipelines and components have resulted in numerous system shutdowns and repairs since the system began operation in August 2017. Replacement and upgrade of the system discharge pipeline and the wellhead piping inside the recovery well vaults was completed in 2021. To improve system reliability and reduce risk of additional pipeline failures, replacement of the system influent pipelines is anticipated to begin in 2H 2022.
- The final as-built drawing set is complete and will be provided in the forthcoming Remedial Action Report (RAR).

Remedial Actions to be Completed in the Next Reporting Period

- Hydraulic control and LNAPL recovery system – Operate while continuing to optimize system performance, replace influent pipelines to improve system reliability and longevity.
- Supplemental LNAPL gauging and recovery – Perform while the remedial system is offline for pipeline replacement and upgrade.
- Ground water monitoring – Continue quarterly.
- Ground water sampling – Continue quarterly.

Permits

- NJDEP Water Allocation Permit No. 2633P.

Program Supporting Documentation and Prior Approvals

- The *Remedial Action Selection Report* (RASR) was submitted to the NJDEP in July 2010 and subsequently approved on October 15, 2010.

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- The RAW and RAWA were submitted to the NJDEP in November 2011 and May 2012, respectively, and subsequently approved on May 31, 2012.
- The *PDI Report for IAOCs D3a, D4, and A9* was submitted in December 2013 for review by the LSRP and subsequently approved by the NJDEP on March 18, 2014.
- The *50% Design Report for IAOCs D3a, D4, and A9* was submitted in February 2014 for review by the LSRP and subsequently approved by the NJDEP on June 9, 2014.
- The *Final Design Report* was submitted in January 2015 for review by the LSRP and subsequently approved by the NJDEP on July 10, 2015.
- The *IAOC D4 RAWA* was submitted to and approved by the NJDEP on July 6, 2016.
- April 13, 2022, NJDEP approval of the 2H 2021 SAPR which proposed discontinuation of semi-annual surface water inspections.

4.4 IAOC F1 - 40-Acre Tankfield Bioslurping System

The 40-Acre Tankfield (IAOC F1) is located southwest of the main refinery area. The 40-Acre Tankfield is an active rail yard used for the import and storage of petroleum products. The property, owned by P66, contains above ground storage tanks, piping, distribution equipment, as well as an active rail yard leased by P66 Partners. The current approved remedial action for LNAPL recovery consists of a bioslurping (BSP) system. A review of the current remedial strategy for this area is being conducted as described below. This review consists of evaluating the current extent and magnitude of LNAPL and alternative remedial options for this area of the site. Following completion of this evaluation, a review of the remedial strategy will be completed, and a summary will be provided to the LSRP and the NJDEP, along with the proposed actions for this area of the site.

Remedial Action Components

- The BSP system which consists of high-vacuum blowers connected to 18 extraction wells is currently offline.

Remedial Actions Completed During the Reporting Period

- The BSP system remained shut down throughout the reporting period.
- As referenced in the 2H 2021 SAPR, the installation of a LNAPL accumulation trench that is approximately 8 feet long, approximately 4 feet wide, and approximately 6 feet deep in the southwest portion of the trench and 5.5 feet deep in the northeastern portion of the trench was completed (**Figure 4.4-1**) in August 2021. Prior to these activities, F1-VP-2 and F1-VP-3 were abandoned. Two LNAPL accumulation sumps (RS-F1 and RS-F2) were installed, and the trench was backfilled to approximately 2 feet below grade with pea gravel. Geofabric was laid over the pea gravel and dense-grade aggregate and $\frac{3}{4}$ " stone were used to restore the area to match the surrounding grade. Additional details related to these activities are scheduled to be included in a future Remedial Action Workplan Addendum to the NJDEP.
- Bi-Weekly LNAPL gauging was completed during the first six weeks of 2022. Measurable LNAPL was not detected in the monitoring points gauged except for BSP-15 (0.01 ft during 2/21/22 gauging event). Based on these results and as proposed in the 2H 2021 SAPR, the LNAPL gauging schedule was changed to quarterly and the results of the 2Q gauging event indicated that measurable LNAPL was not detected in the monitoring points gauged (**Table 4.4-1**). Absorbent socks remain in select wells and are changed out based on either the detection of LNAPL in the well or visual observations indicating they need to be changed. The locations of the wells and the gauging frequency are shown on **Figure 4.4-1**.

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- Ground water monitoring is being implemented until a review of the remedial strategy is completed and an alternative remedial measure is implemented.

Status at the End of the Reporting Period

- The BSP system is offline. As stated above, the LNAPL accumulation trench was installed in 2H 2021. Based on the 2021 and 2022 gauging data and as proposed in the 2H 2021 SAPR, the gauging frequency for the wells was reduced to quarterly.
- Soil sampling activities were initiated in June 2022 to evaluate the current extractable petroleum hydrocarbons (EPH) concentrations in the area of the BSP system.

Remedial Actions to be Completed in the Next Reporting Period

- Ground water monitoring – Gauge wells to monitor LNAPL thicknesses.
- LNAPL recovery from system wells with measurable LNAPL – As needed.
- Visual inspection and replacement of absorbent socks until the BSP system is operational or an alternative remedial action is implemented – As needed.
- Continued evaluation of the current extent and magnitude of LNAPL and alternative remedial options. This includes evaluation of the following activities:
- Continuation of additional soil sampling for EPH analysis;
- Alternative LNAPL recovery options (following continued evaluation of the effects of the LNAPL accumulation trench activities); and
- A Natural Source Zone Depletion evaluation to supplement the LNAPL conceptual site model.
- Following completion of the above activities, a review of the remedial strategy will be completed, and a summary will be provided to the LSRP and the NJDEP, along with the proposed actions for the area of the site.

Permits

- NJDEP Air Pollution Control Pre-Construction Permit No. PCP130001 for BSP system operation.
- NJDEP Water Allocation Permit No. 2633P.

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Program-Supporting Documentation and Prior Approvals

- February 22, 2012, NJDEP approval of the *Revised F1/F2 RAW*.
- August 31, 2015, NJDEP approval of the *F1/F2 Soil RAR*.
- July 30, 2014, NJDEP approval of the *F3 (40-Acre Undeveloped Property) Revised Focused Feasibility Study Report (FFSR)/RAW*.
- October 8, 2015, NJDEP approval of the 1H 2015 SAPR.

5 REMEDIAL ACTION OPERATION, MAINTENANCE, AND MONITORING

This section summarizes the remedial action OMM activities performed in the areas where remediation programs have been established. These programs include:

- IAOC A8 (GBT) – Hydraulic control system and AOC specific controls (**Section 5.1**);
- IAOC A9 (Conservation Area) – Hydraulic control system and AOC specific controls (**Section 5.2**);
- IAOC A10 (GCT) – Hydraulic control system and AOC specific controls (**Section 5.3**);
- IAOC A13 (Domestic Trade Terminal and Tankfield) – Hydraulic control system and AOC specific controls (**Section 5.4**);
- IAOC A14 (Greater Elizabeth Tankfield) – AOC specific controls (**Section 5.5**);
- IAOC D1 (Tremley Tankfield) and IAOC D2 (Former Lower Tremley Tankfield Separator) – AOC specific controls and MNA ground water sampling (**Section 5.6**);
- IAOC D3a (Current and Former Diesel Tankfield) and IAOC D4 (Tank 519 Creek Dredging Area) – AOC specific controls (**Section 5.7**);
- IAOC D6 (Western Shore of Reservoir) – MNA ground water sampling (**Section 5.8**);
- Four-Landfill Area – IAOC E2 (Eastern Landfill), IAOC E3 (Central Landfill), IAOC E4 (Western Landfill), and IAOC E5 (Southern Landfill) – Hydraulic control system and AOC specific controls (**Section 5.9**);
- IAOC F2 (Former 40-Acre Tankfield Separator) and IAOC F3 (40-Acre Tankfield Undeveloped Property) – MNA ground water sampling (**Section 5.10**); and
- IAOC L (SLOU) – Hydraulic control system and AOC specific controls (**Section 5.11**).

This section also summarizes site-wide overburden ground water monitoring activities including:

- Site-Wide Annual LNAPL Monitoring (**Section 5.12**) and
- Site-Wide Annual Overburden Ground Water Sampling (**Section 5.13**).

5.1 IAOC A8 - Gasoline Blending Tankfield Remediation

Ground Water Remediation Strategy Program Requirements

- Perimeter containment and hydraulic control of dissolved-phase COCs and LNAPL-impacted ground water to prevent potential impact to surface water.
- Ground water monitoring – Quarterly.
- Ground water sampling – Annually.

Ground Water Remediation Strategy Program Requirements Met

- The program requirements were met during the reporting period, as detailed below.

Ground Water Monitoring Summary

- Quarterly ground water monitoring events were completed on March 11 and April 22, 2022 (**Table 5.1-1** and **Figures 5.1-1** and **5.1-2**). Select wells in adjacent IAOCs were monitored in conjunction with those in IAOC A8, and were used to determine ground water elevations, contours, and flow directions. The ground water monitoring data from these wells is included in **Table 5.1-1** and on **Figures 5.1-1** and **5.1-2**.
- Due to the limited clearance between the outside of the pneumatic pumps and the inside of the 4-inch diameter GBT recovery wells, accurate depths to LNAPL and/or ground water cannot be measured when the drawdown within the recovery well is below the top of the pump (e.g., RW-2 during both events). In these instances, the corrected ground water elevation at the recovery well is depicted on the table and figures as lower than the calculated elevation of the top of the pump.
- The pump in recovery well RW-3 was operational during the 1Q gauging event; however, the vault was observed to be flooded during the event with water levels just below the top of the well casing as reported on **Table 5.1-1**. Recovery well RW-3 is located in an area formerly excavated by P66 and the vault typically floods following precipitation events as surface runoff accumulates in the excavation backfill.
- LNAPL detections during the quarterly events ranged from a film in several monitoring wells to an apparent thickness of 0.44 feet detected in recovery well RW-11 (1Q) (**Table 5.1-1**). Excluding the detection in recovery well RW-11, the LNAPL detections were consistent with historical data. The LNAPL detections were in wells or monitoring points located inland of the barrier walls and/or within the capture zone of the system.

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- LNAPL was first detected in recovery well RW-11 in February 2022. In response, several vacuum extraction events were performed to recover LNAPL from the well and weekly gauging events were initiated for wells in the vicinity of RW-11 (**Table 5.1-2**). The bottom-loading pump in the recovery well was also replaced with a top-loading pump on March 21, 2022. LNAPL was last detected in the well during the 1Q gauging event on March 11, 2022, and the supplemental weekly gauging events were terminated with the 2Q gauging event completed on April 22, 2022.

Ground Water Analytical Results Summary

- Because the annual ground water sampling event was not completed during this reporting period, the results will be presented in the 2H 2022 SAPR..

System Components

- Hydraulic barrier wall – The barrier wall is constructed of approximately 1,330 total linear feet of steel sheet pile wall keyed into glacial till. There are five sections of barrier wall, with gaps of varying width between the sections where utility crossings and refinery infrastructure prevented the installation of additional barrier wall.
- Hydraulic control system – The system consists of pneumatic pumps operated within a network of 12 recovery wells located inland of the barrier wall and near gaps within or at the ends of the barrier wall sections. Recovered total fluids are processed through an oil/water separator prior to the recovered ground water being discharged to the P66 WWTP via the SLOU Force Main. Recovered LNAPL is transported to the P66 WWTP via vacuum truck.

System Performance

- System runtime was approximately 91% during the reporting period. The longest period of downtime during 1H was between February 11 and 14, 2022, and was associated with an air compressor high oil temperature alarm. Additional downtime during the period consisted of multiple short-duration shutdowns for routine maintenance and alarm activations, most of which were less than 24 hours in duration.
- Based on flow totalizer readings, approximately 3,144,810 gallons of total fluids were recovered during the reporting period and discharged to the P66 WWTP. The system flow rate averaged approximately 13.2 gpm during operation.
- During system operation, each of the 12 recovery wells were operational during the reporting period; however, routine inspections throughout the period identified select pumps that required maintenance to address typical fouling issues, resulting in limited-duration deactivations of individual recovery pumps.

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- As reported in the 2H 2020 SAPR, absorbent socks were placed into wells P-7 and SBMW-8S in 2020 in response to increased LNAPL thickness detections in the wells and to provide LNAPL recovery while the hydraulic control system was offline for upgrades. Although system operations have resumed, the absorbent socks continued to be maintained in the two wells until their removal immediately following the 1Q gauging event completed on March 11, 2022. If an increase in LNAPL thickness is measured during the quarterly gauging events, the need to reinstall the socks in the wells will be evaluated.
- An absorbent sock was installed in monitoring well SBMW-11S following the 1Q gauging event on March 11, 2022. The condition and performance of the sock will be monitored during quarterly gauging events.

Hydraulic Control Summary

- Ground water contour maps for the 1Q and 2Q gauging events (**Figures 5.1-1 and 5.1-2**, respectively) indicate that the inferred ground water flow directions in the GBT area are primarily from inland areas towards the barrier wall and extraction system recovery wells, and that localized gradients toward the recovery wells are present. Localized hydraulic gradients towards Moses Creek were apparent in the following monitoring locations near gaps in the barrier wall in 1Q: APZ-122, GMW-71, P-9, SBMW-8S and S-10, and in 2Q: APZ-122, APZ-123, GMW-71, P-7, P-9, SBMW-8S, S-9 and S-10. Some of the variations in hydraulic gradient direction may be affected by timing of the gauging relative to changes in surface water elevation and corresponding lag in ground water response.
- System extraction rates are reviewed to support evaluation of hydraulic control and to monitor system performance. The GBT ground water containment and LNAPL recovery system was designed with a target ground water system flow rate of approximately 7.7 gpm. As stated above, the ground water system flow rate for 1H was approximately 13.2 gpm during operation.
- System operations continue to be evaluated, with improvement activities completed/to be completed based on the findings. Currently, planning is underway for the installation of additional piezometers and the completion of supplemental monitoring to evaluate flow conditions at select gaps in the barrier wall. Following the installation of the piezometers and subsequent monitoring, an evaluation of potential system enhancements is planned to be completed.

Soil Remediation Strategy

- An institutional control (Deed Notice) for the GBT restricts this area to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019, and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by

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the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.

- AOC specific controls (soil capping and signs) mitigate direct contact with soils. See **Figure 5.1-3** for location of AOC specific controls.
- Visual inspections of the AOC specific controls – Semiannually.
- Visual inspections of the signs associated with the ECP; agreed upon between ExxonMobil and P66 – Quarterly.

AOC Specific Control – Existing Surface Cap

- Areas with surface soil sample results above the applicable NJDEP SRS utilized existing ground cover include:
 - Tank Berm 119 cap;
 - Portions of the cap located south of spheroids 197, 198, and 199;
 - Portions of the cap located around Tank 350, Tank 351, and Tank 354 berms; and
 - Sulfuric Acid and Regeneration Plant.

AOC Specific Control – Installed Cap within Tank Berms

- Areas within tank berms were graded down to 6 inches below ground surface and orange, high-visibility, non-woven geotextile demarcation liner was installed along the base and sidewalls. A 6-inch layer of certified clean dense grade aggregate (DGA) material was installed and compacted. These areas include:
 - Tank 349, Tank 353, and Tank 356 berm caps; and
 - Portions of the cap located around Tank 350, Tank 351, and Tank 354 berms.

AOC Specific Control – Installed Cap outside of Tank Berms

- Areas outside of tank berms were graded down to 12 inches below grade surface and orange, high-visibility, non-woven geotextile demarcation liner was installed along the base and sidewalls. A 12-inch layer of certified clean DGA material was installed and compacted. These areas include portions of the cap located south of spheroids 197, 198, and 199.

Results of Inspection

- AOC specific controls (caps) were inspected in 1H. See **Figure 5.1-3** for results of inspection.
- One of the caps maintained by ExxonMobil located south of spheroids 197, 198, and 199 was breached in 2H 2020 by P66 to continue the investigation of their May 13, 2017, release (NJDEP Case # 17-05-13-1450-01). Additional delineation activities were completed by P66 in 1H 2021. To date, ExxonMobil has not received results of these delineation activities. This area will continue to be inspected and the repairs will be documented (when completed).
- Third party equipment was staged on the existing cap located south of Sphere 199 during the 1H inspection; however, no signs of erosion or concern of cap integrity were noted.
- A soil pile was staged on the installed cap in the vicinity of GMW-225 which is located within the berm surrounding Tank 349 during the 1H inspections. No signs of erosion or concern of cap integrity were noted on the visible portions of the caps located within the berm surrounding Tank 349. During the 1H inspection, it was confirmed that no additional soil was added to the pile noted from the previously completed 2H 2021 inspection.
- Third party equipment was staged on top of the southwest corner of the installed cap located in tank berm 353 during the 1H inspections; however, no impact to the integrity of the cap was noted.
- Third party equipment staged on the west corner of the installed cap located in tank berm 354 during the 1H inspection; however, no signs of erosion or concern of cap integrity were noted.
- Visual inspections of the signs associated with the ECP were completed in 1Q and 2Q and no disturbances to the signs were noted.

Surface Water Inspection

- Semiannual surface water inspections were discontinued beginning in 1H 2022 per NJDEP April 13, 2022, approval of the 2H 2021 SAPR. Extended periods of downtime associated with the GBT system did not occur in 1H 2022.
- If sheen is present on the surface water bodies, it is captured by absorbent booms deployed by P66 (regardless of contributing factor or source). The P66-maintained boom is outside the scope of ExxonMobil's activities.

Recommendations and Path Forward

- GBT hydraulic control system – Operate while continuing to optimize system performance. Install piezometers and conduct supplemental monitoring to further evaluate hydraulic control and develop plans for additional system improvements, if warranted.
- Ground water monitoring – Continue quarterly gauging.
- Ground water sampling – Continue annual sampling.
- Visual inspections of AOC specific controls – Continue semiannually.
- Visual inspections of the signs associated with ECP – Continue quarterly.

Permits

- NJDEP Water Allocation Permit No. 2633P.

Program Supporting Documentation and Prior Approvals

- July 29, 2008, NJDEP approval of the 2007 Revised RAW.
- The GBT remedial actions were constructed based on the NJDEP-approved June 2009 *Detailed Design Report (DDR)* and the *Revised Remediation Action Approach – Technical Memorandum* and requisite modifications.
- September 26, 2014, NJDEP approval of the GBT RAWA.
- The post-remedial monitoring and sampling events are completed based on the monitoring requirements of the GBT RAR.
- January 8, 2018, NJDEP approval of *GBT Remedial Action Report Addendum (RARA)* – Reduced ground water sampling from quarterly to annually.
- The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019.
- The *GBT Soil RAR* was submitted to the NJDEP on May 11, 2020. A response is pending as of the end of this reporting period.
- April 13, 2022, NJDEP approval of the 2H 2021 SAPR which proposed discontinuation of surface water inspections, except during extended periods of system downtime.

5.2 IAOC A9 - Conservation Area

Ground Water Remediation Strategy Program Requirements

- Perimeter containment and hydraulic control of dissolved-phase COCs and LNAPL-impacted ground water to prevent potential impact to surface water.
- Ground water monitoring – Quarterly.
- Ground water sampling – Annually.

Ground Water Remediation Strategy Program Requirements Met

- The program requirements were met during the reporting period, as detailed below.

Ground Water Monitoring Summary

- Quarterly ground water monitoring events were conducted on March 11 and April 22, 2022 (**Table 5.2-1** and **Figures 5.2-1** and **5.2-2**). Select wells in adjacent IAOCs were monitored in conjunction with those in IAOC A9, and were used to determine ground water elevations, contours, and flow directions. The ground water monitoring data from these wells is included in **Table 5.2-1** and on **Figures 5.2-1** and **5.2-2**.
- Due to the limited clearance between the outside of the pneumatic pumps and the inside of the 4-inch diameter GBT and GCT recovery wells, accurate depths to LNAPL and/or ground water cannot be measured when the drawdown within the recovery well is below the top of the pump (e.g., RW-29 during the 2Q event). In these instances, the corrected ground water elevation at the recovery well is depicted on the table and figures as lower than an elevation calculated using the measured depth to top of pump.
- An obstruction was encountered in monitoring well GMW-284 during the 1Q gauging event, thereby affecting the accuracy of the corrected ground water elevation for the well. The obstruction was not encountered in 2Q.
- LNAPL detections within IAOC A9 during the quarterly gauging events ranged from a film in recovery wells RW-A9-2, RW-A9-3, and RW-A9-4 (1Q) to an apparent thickness of 0.02 feet in piezometer APZ-120 (1Q) (**Table 5.2-1**). During the 2Q event, LNAPL thickness could not be quantified for piezometer APZ-120 and recovery well RW-A9-3 because the viscous LNAPL detected in the wells fouled the probe and did not allow for accurate depth to ground water measurements. In these instances, the corrected ground water elevation is lower than or equal to the elevation presented on **Table 5.2-1** which was calculated using the measured depth to LNAPL. The LNAPL detections were consistent with

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historical thicknesses observed within IAOC A9 and were in wells or monitoring points located inland of the barrier walls and within the capture zone of the system.

Ground Water Analytical Results Summary

- The annual ground water sampling event was completed between March 16 through April 5, 2022 (**Tables 5.2-2** through **5.2-4** and **Figure 5.2-3**).
- Constituents detected at concentrations above the NJDEP Class II-A GWRS included benzene, total VOC TICs, 1,4-dioxane, total VOC and SVOC TICs, total arsenic, and total lead. Dissolved metals were analyzed in select monitoring wells.
 - Benzene, 1,4-dioxane, total SVOC TICs, total arsenic and/or total lead were detected at concentrations exceeding their respective NJDEP Class II-A GWRS in piezometers APZ-122 and APZ-123, which are located at the eastern end of the barrier wall and Dam 2 Recovery Trench in IAOC A8. Localized hydraulic gradients toward Moses Creek were observed at this gap in the hydraulic barrier wall in 1H, as detailed in **Section 5.1**. Additional evaluation of hydraulic control at gaps in the barrier wall will be conducted and the results will be submitted under separate cover.
 - Benzene and total VOC and SVOC TICs were detected at concentrations exceeding the NJDEP Class II-A GWRS in monitoring well GMW-124. Because this well is located upgradient of the A9 remediation system, no additional action is required but concentrations of these compounds will continue to be monitored.
 - Total VOC TICs were detected at a concentration exceeding the NJDEP Class II-A GWRS in monitoring well GMW-124. Because this well is located upgradient of the A9 remediation system, no additional action is required but concentrations of total VOC TICs will continue to be monitored.
 - 1,4-Dioxane was detected at concentrations exceeding the NJDEP Class II-A GWRS in monitoring wells DAM2-MW-2 and GMW-283. Because DAM2-MW-2 is located within the hydraulic capture zone of the A9 remediation system and GMW-283 is located upgradient of the A9 remediation system, no additional action is required but concentrations of 1,4-dioxane will continue to be monitored.
 - Total VOC TICs were detected at a concentration exceeding the NJDEP Class II-A GWRS in monitoring wells DAM2-MW-2 and GMW-124. Because DAM2-MW-2 is located within the hydraulic capture zone of the A9 remediation system and GMW-124 is located upgradient of the A9 remediation system, no additional action is required but concentrations of total SVOC TICs will continue to be monitored.

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- Total arsenic was detected at a concentration exceeding the NJDEP Class II-A GWRS in monitoring wells GMW-120, GMW-135, and GMW-657. Monitoring well GMW-120 is located within the hydraulic capture zone of the A9 remediation system. Monitoring well GMW-135 is located upgradient of the A9 remediation system. Monitoring well GMW-657 is located outside of the barrier wall near the Freshwater Reservoir but within the hydraulic capture zone of the A9 remediation system.
 - Total lead was detected at a concentration exceeding the NJDEP Class-IIA GWRS in monitoring well GMW-657, which is located outside of the barrier wall near the Freshwater Reservoir but within the hydraulic capture zone of the A9 remediation system.
 - The applicable Surface Water Quality Standards (Fresh or Saline) are shown on **Figure 5.2-3**. These were added as part of a continuing evaluation of the effectiveness of the hydraulic control system that will be included in a future report. No surface water samples were collected.
- Ground water sampling logs and confirmation emails of EDD submissions are provided electronically on the attached CD (**Attachment A-3**).

System Components

- Hydraulic barrier walls – The A9 and No. 2 Dam barrier walls are constructed of steel sheet pile wall keyed into glacial till with respective total wall section lengths of approximately 570 and 550 linear feet. There are five sections of A9 barrier wall, with gaps of varying width between the sections where utility crossings and refinery infrastructure prevented the installation of additional sheet pile wall. The No. 2 Dam system consists of two wall sections.
- Hydraulic control systems – Hydraulic control is maintained for IAOC A9 by two separate recovery systems – the A9 system and the No. 2 Dam system. The A9 system consists of pneumatic pumps operated within a network of 6 recovery wells located inland of the barrier wall and near gaps within or at the ends of the barrier wall sections. Recovered total fluids are processed through an equalization tank prior to being discharged to the P66 WWTP via the SLOU Force Main. The No. 2 Dam system consists of an approximately 475-foot-long interceptor trench operated inland of the No. 2 Dam barrier wall. The trench terminates at a collection manhole equipped with an electric submersible pump that discharges total fluids to the P66 WWTP via the SLOU Force Main.

A9 System Performance

- The A9 system runtime was approximately 84% during the reporting period. The longest period of downtime during 1H was between February 8 and 16, 2022, and was attributed to

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a preventative maintenance event that involved jetting and flushing of the system's influent pipeline. Additional downtime events during the period consisted of multiple short-duration shutdowns for routine maintenance and alarm activations, the majority of which were less than 24 hours in duration.

- Based on discharge totalizer readings, approximately 1,736,695 gallons of ground water were recovered during the reporting period and discharged to the P66 WWTP. The system flow rate averaged approximately 7.9 gpm during operation.
- During system operation, each of the six A9 system recovery wells were operational during the reporting period; however, routine inspections throughout the period identified select pumps that required maintenance to address typical fouling issues, resulting in limited-duration deactivations of individual recovery pumps.
- LNAPL has historically been detected in recovery well RW-A9-2, which is located proximal to a gap in the hydraulic barrier wall. The bottom-loading pump originally operated in the well was replaced with a top-loading pneumatic pump on June 3, 2022, to more effectively contain and recover the LNAPL in this location. During this reporting period, LNAPL was only detected in IAOC A9 as a film.
- In accordance with the Road Map and based on system operational status, supplemental LNAPL recovery activities were not required.

No. 2 Dam System Performance

- The No. 2 Dam system runtime was approximately 98% during the reporting period. Downtime events during the period consisted primarily of short-duration shutdowns for routine maintenance (each typically less than 24 hours in duration).
- Based on discharge totalizer readings, approximately 3,321,393 gallons of ground water were recovered during the reporting period by the system and discharged to the P66 WWTP. The system flow rate averaged approximately 12.9 gpm during operation.

Hydraulic Control Summary – A9 and No. 2 Dam Systems

- Ground water contour maps for the quarterly monitoring events (**Figures 5.2-1 and 5.2-2**) indicate that the inferred ground water flow directions in the western portion of IAOC A9 are primarily towards the barrier wall and extraction system recovery wells. These patterns are consistent with historical gauging data that demonstrated hydraulic control.
- Ground water contour maps for the 1Q and 2Q gauging events (**Figures 5.2-1 and 5.2-2**) show overall ground water flow towards the No. 2 Dam system recovery trench, and a westerly hydraulic gradient from DAM2-MW-1 to DAM2-MW-2, indicating that ground

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water within the southeastern portion of IAOC A9 is hydraulically controlled by the No. 2 Dam interceptor trench system.

Soil Remediation Strategy

- An institutional control (Deed Notice) for the Conservation Area restricts this area to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019, and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.
- AOC specific controls (soil capping and signs) to mitigate direct contact with soils and/or prevent the potential for migration of impacts to ground water. See **Figure 5.2-4** for location of AOC specific controls.
- Visual inspections of the AOC specific controls – Semiannually.
- Visual inspections of the sign associated with ECP – Quarterly.

AOC specific control - Cap A9

- Existing surface cap for areas with surface soil sample results above the applicable NJDEP SRS and areas with existing asphalt or concrete as cover.

AOC specific controls - Cap A9-8

- 12 inches of clean soil/stone underlain by a permeable filter fabric (geotextile demarcation layer) or stone/aggregate and the underlying impacted soils.
- Additional soil or stone/aggregate was added, as needed, to achieve the minimum cap thickness.

Results of Inspections

- AOC specific controls (caps) were inspected in 1H. See **Figure 5.2-4** for results of the inspection.
 - Cap A9-8 AOC specific control is located within a third-party laydown yard. Equipment was staged and tire tracks were noted on the cap; however, no signs of erosion or concern of cap integrity were noted.

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- On April 4, 2022, while mobilizing to the A9 ground water remediation system for routine inspections, Kleinfelder noted that a section of aboveground piping, along with underlying stone, had been removed from AOC specific control (cap) for this area. ExxonMobil will continue to follow up with P66 regarding this incident.
- Visual inspections of the signs associated with the ECP were completed in 1Q and 2Q and no disturbances to the signs were noted.

Surface Water Inspection

- Semiannual surface water inspections were discontinued beginning in 1H 2022 per NJDEP April 13, 2022, approval of the 2H 2021 SAPR. One interim surface water inspection was completed in February while the hydraulic control system was offline for a preventative maintenance event that involved jetting and flushing of the system's influent pipeline. Sheen was not observed on the surface water from the bank side of the wall during the weekly inspection. The interim surface water inspection sheets are maintained by ExxonMobil and are available upon request.
- If a sheen is present on the surface water bodies, they are captured by absorbent booms deployed by P66 (regardless of contributing factor or source). The P66-maintained boom is outside the scope of ExxonMobil's activities.

Recommendations and Path Forward

- A9 and No. 2 Dam hydraulic control systems – Operate while continuing to optimize system performance.
- Ground water monitoring – Continue quarterly gauging.
- Ground water sampling – Continue annual sampling.
- Visual inspections of AOC specific controls – Continue semiannually.
- Visual inspections of the signs associated with ECP – Continue quarterly.

Permits

- NJDEP Water Allocation Permit No. 2633P.

Program Supporting Documentation and Prior Approvals

- October 15, 2010, NJDEP approval of the RASR.
- May 31, 2012, NJDEP approval of the RAW and RAWA.

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- March 18, 2014, NJDEP approval of the *PDI Report for IAOCs D3a, D4, and A9*.
- June 9, 2014, NJDEP approval of the *50% Design Report for IAOCs D3a, D4, and A9*.
- July 10, 2015, NJDEP approval of the *Final Design Report*.
- The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019.
- The RAR was submitted to the NJDEP in November 2020. NJDEP provided comments on the RAR in correspondence dated April 12, 2022. ExxonMobil is in the process of evaluating the NJDEP's comments and will provide responses in a separate document.
- April 13, 2022, NJDEP approval of the 2H 2021 SAPR which proposed discontinuation of surface water inspections, except during extended periods of system downtime.

5.3 IAOC A10 - Gasoline Component Tankfield Remediation

Ground Water Remediation Strategy Program Requirements

- Perimeter containment and hydraulic control of dissolved-phase COCs and LNAPL-impacted ground water to prevent potential impact to surface water.
- Ground water monitoring – Quarterly.
- Ground water sampling – Annually.

Ground Water Remediation Strategy Program Requirements Met

- The program requirements were met during the reporting period, as detailed below.

Ground Water Monitoring Summary

- Quarterly ground water monitoring events were completed on March 11 and April 22, 2022 (**Table 5.3-1** and **Figures 5.3-1** and **5.3-2**). Select wells in adjacent IAOCs were monitored in conjunction with those in IAOC A10, and were used to determine ground water elevations, contours, and flow directions. The ground water monitoring data from these wells is included in **Table 5.3-1** and on **Figures 5.3-1** and **5.3-2**.
- Due to the limited clearance between the outside of the pneumatic pumps and the inside of the 4-inch diameter GCT recovery wells, accurate depths to LNAPL and/or ground water cannot be measured when the drawdown within a recovery well is below the top of the pump (e.g., RW-16 during both quarterly events). In these instances, the corrected ground water elevation at the recovery well is depicted on the table and figures as lower than an elevation calculated using the measured depth to top of pump.
- LNAPL detections within IAOC A10 during the quarterly gauging events ranged from an apparent thickness of 0.20 feet in piezometer P-14 during the 2Q event to 1.39 feet in monitoring well GMW-222 during the 2Q event (**Table 5.3-1**). The LNAPL detections were consistent with historical thicknesses observed within IAOC A10 and were in wells or monitoring points located inland of the barrier walls and within the capture zone of the system. LNAPL was also detected in several of the IAOC A9 wells that are gauged as part of the GCT system performance monitoring plan, including APZ-120, RW-A9-2, and RW-A9-3 (**Section 5.2**).

Ground Water Analytical Results Summary

- The annual ground water sampling event was completed between February 28 and March 14, 2022 (**Tables 5.3-2** through **5.3-4** and **Figure 5.3-3**).

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- Piezometer P-14 was not sampled due to measurable LNAPL during the event. This is consistent with historical conditions in this well.
- COCs detected at concentrations above the NJDEP Class II-A GWRS during the annual event included total lead. The exceedances are consistent with historical results or were detected in monitoring wells located on the interior of the hydraulic barrier wall in the GCT area.
- As reported in previous SAPRs, concentrations of lead detected monitoring wells S-13 and S-21 in 2020 were 190 µg/L and 17 µg/L, respectively. Based on the turbidity readings measured during sampling, these wells were redeveloped in April 2021. The 2021 lead concentrations detected in these wells were 51 µg/L (S-13) and 7.6 µg/L (S-21). During the 2022 ground water sampling event, total lead concentrations in these wells were 75 µg/L B F1 (S-13) and 4.7 µg/L (S-21). Dissolved lead concentrations in these wells were 3.8 B (S-13) and 0.11 J (S-21). The qualifier B indicates that the analyte was also detected in the associated blank. The qualifier F1 indicates that the matrix spike and/or matrix spike duplicate recovery exceeded control limits. The laboratory will continue to be engaged in identifying solutions to these issues.
- The Fresh Surface Water Quality Standards are shown on **Figure 5.3-3**. These were added as part of a continuing evaluation of the effectiveness of the hydraulic control system that will be included in a future report. No surface water samples were collected.
- Ground water sampling logs and confirmation emails of EDD submissions are provided electronically on the attached CD (**Attachment A-4**).

System Components

- Hydraulic barrier wall – The barrier wall is constructed with approximately 1,927 total linear feet of steel sheet pile wall keyed into glacial till. There are three sections of barrier wall, with gaps of varying width between the sections where utility crossings and refinery infrastructure prevented the installation of additional sheet pile wall.
- Hydraulic control system – The system consists of pneumatic pumps operated within a network of 17 recovery wells located inland of the barrier wall and near gaps within or at the ends of the barrier wall sections. Recovered total fluids are discharged directly to the BRC process sewer system for treatment at the P66 WWTP.

System Performance

- System runtime was approximately 68% during the reporting period. On May 2, 2022, the GCT system was temporarily shut down to facilitate the execution of an improvement project that is detailed later within this section. The system remained offline for the remainder of the reporting period. Outside of this planned shutdown event, runtime was over 99% in 1H 2022

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with two short-duration shutdowns for routine maintenance that were each approximately 30 minutes in duration.

- Based on flow totalizer readings, approximately 1,545,108 gallons of total fluids were recovered by the extraction system during the reporting period and discharged to the P66 WWTP. The system flow rate averaged approximately 8.7 gpm during operation.
- During system operations, each of the 17 recovery wells were operational during the reporting period; however, routine inspections throughout the period identified select pumps that required maintenance to address typical fouling issues, resulting in limited-duration deactivations of individual recovery pumps.
- The GCT System Cleanout Installation Project was initiated on May 2, 2022, and continued through July 29, 2022. GCT system operations have historically been affected by pipeline fouling that has restricted system recovery rates and impacted the system's performance. The original piping design did not include cleanouts or other access points to facilitate mechanical cleaning. The effectiveness of flushing events was variable, and several chemical cleaning events were previously required to restore pipeline performance. To allow for pipeline maintenance with the water jetting equipment that has proven to be effective for other onsite system pipelines, the pipeline was modified to incorporate multiple cleanouts and access points during the improvement project. Going forward, jetting and flushing events will be performed on a routine basis to maintain pipeline performance and optimize system operations.

Hydraulic Control Summary

- The ground water contour maps presented as **Figures 5.3-1** and **5.3-2** indicate that hydraulic control is achieved via the barrier wall and recovery well system components. Ground water levels and contours indicate that the inferred ground water flow directions in the GCT are primarily towards the barrier wall and extraction system recovery wells. These patterns are consistent with historical gauging data that demonstrated hydraulic control.
- Additionally, system extraction rates are evaluated to assess hydraulic control and to monitor system performance. The GCT ground water and LNAPL recovery system was designed with a long-term average target ground water system flow rate of approximately 7.6 gpm. The average system recovery rate during 1H was above the long-term target rate at approximately 8.7 gpm.
- The ground water monitoring data indicates that overall, the GCT recovery system is operating as designed and is achieving hydraulic control. The GCT system will continue to be optimized and details will be provided in subsequent SAPRs, as appropriate.

Soil Remediation Strategy

- An institutional control (Deed Notice) for the GCT restricts this area to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019, and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.
- AOC specific controls (soil capping and signs) mitigate direct contact with soils. See **Figure 5.3-4** for location of AOC specific controls.
- Visual inspections of the AOC specific controls – Semiannually.
- Visual inspections of the sign associated with ECP – Quarterly.

AOC Specific Control – Installed Cap within Tank Berms

- Areas within tank berms were graded down to 6 inches below ground surface and orange, high-visibility, non-woven geotextile demarcation liner was installed along the base and sidewalls. A 6-inch layer of certified clean DGA material was installed and compacted. These areas include:
 - Tank 242; and
 - Portions of the cap located around Former Tank 240 and Tank 245 berms.

Results of Inspection

- AOC specific controls (caps) were inspected in 1H. See **Figure 5.3-4** for results of inspection.
 - Debris was observed on top of the southeast corner of the installed cap located in tank berm 242 during the 1H inspections; however, no impact to integrity of cap was noted.
 - Third party equipment was staged on top of the northwest corner of the installed cap located in tank berm 245 during the 1H inspections; however, no impact to integrity of cap was noted.
- Visual inspections of the signs associated with the ECP were completed in 1Q and 2Q and no disturbances to the signs were noted.

Recommendations and Path Forward

- GCT hydraulic control system – Continue operation while optimizing system performance.
- Ground water monitoring – Continue quarterly gauging.
- Ground water sampling – Continue annual sampling (scheduled for 3Q 2022).
- Visual inspections of AOC specific controls – Continue semiannually.
- Visual inspections of the signs associated with ECP – Continue quarterly.

Permits

- NJDEP Water Allocation Permit No. 2633P.

Program Supporting Documentation and Prior Approvals

- The remedial actions were constructed based on the NJDEP-approved May 2009 DDR and the *Revised Remediation Action Approach – Technical Memorandum* and requisite modifications.
- September 26, 2014, NJDEP approval of the GCT RAWA.
- The post-remedial monitoring and sampling events are completed based on the monitoring requirements of the GCT RAR.
- The December 7, 2017, NJDEP approval of GCT RARA reduced the ground water sampling frequency from quarterly to annually.
- The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019.
- The *GCT Soil RAR* was submitted to the NJDEP on May 11, 2020. A response is pending as of the end of this reporting period.

5.4 IAOC A13 - Domestic Trade Terminal and Tankfield Remediation

Ground Water Remediation Strategy Program Requirements

- Perimeter containment and hydraulic control of dissolved-phase COCs and LNAPL-impacted ground water to prevent potential impact to surface water. As stated in the November 2009 RAR, at the time of that report there were several documented releases by the property owner in this IAOC. As such, there is a cost sharing agreement between ExxonMobil and the current property owner where ExxonMobil operates the ground water remediation system, and the property owner reimburses ExxonMobil for a portion of the cost.
- Ground water monitoring – Annually.
- Ground water sampling – Annually.

Ground Water Remediation Strategy Program Requirements Met

- The program requirements were met during the reporting period as detailed below.

Ground Water Monitoring Summary

- The annual ground water monitoring event was completed on March 11, 2022 (**Table 5.4-1** and **Figure 5.4-1**). Select wells in adjacent IAOCs were monitored in conjunction with those in IAOC A13, and were used to determine ground water elevations, contours, and flow directions. The ground water monitoring data from these wells is included in **Table 5.4-1** and on **Figure 5.4-1**.
- LNAPL was detected in one monitoring well during the annual event (DMW-2) at an apparent thickness of 0.39 feet (**Table 5.4-1** and **Figure 5.4-1**), consistent with historical results.

Ground Water Analytical Results Summary

- The annual ground water sampling event was completed between March 15 and 16, 2022 (**Table 5.4-2** and **Figure 5.4-2**).
- Benzene tert-Butyl alcohol (TBA), and lead were detected at concentrations exceeding the NJDEP Class II-A GWRS in the system sample (BLEEDER VALVE). Lead was also detected exceeding the NJDEP Class II-A GWRS in P-3 but was not detected in the filtered metal sample. Targeted constituents were not detected at concentrations exceeding the NJDEP Class II-A GWRS in piezometers P1, P2, and P4.

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- The Fresh Surface Water Quality Standards are shown on **Figure 5.4-2**. These were added as part of a continuing evaluation of the effectiveness of the hydraulic control system that will be included in a future report. No surface water samples were collected.
- Ground water sampling logs and confirmation emails of EDD submissions are provided electronically on the attached CD (**Attachment A-5**).

System Components

- Hydraulic barrier wall – The barrier wall system includes an approximately 600 linear foot high-density polyethylene (HDPE) wall keyed into glacial till with steel sheet pile wall sections overlapping each end of the HDPE wall. The HDPE barrier wall is continuous with no gaps.
- Hydraulic control system – The system consists of an approximately 600-foot-long collection trench operated inland of the HDPE barrier wall. The collection trench terminates at a collection manhole equipped with an electric submersible pump that discharges total fluids to the P66 WWTP via a process sewer connection.

System Performance

- System runtime was approximately 98% during the reporting period. Several short-duration downtime events occurred during the reporting period associated with failures in the onsite power grid that serves the remediation system, each of which was typically less than 24 hours in duration.
- Based on flow totalizer readings, approximately 2,035,158 gallons of total fluids were recovered by the system during the reporting period and discharged to the P66 WWTP via a process sewer connection. The system flow rate averaged approximately 7.9 gpm during operation.

Hydraulic Control Summary

- Ground water elevation contours and inferred ground water flow directions for the annual monitoring event depicted on **Figure 5.4-1** show overall ground water flow towards the Domestic Trade system recovery trench, and ground water elevations in monitoring points at the ends of the collection trench show a gradient towards the recovery trench. These conditions confirm that ground water is hydraulically controlled within the IAOC and at each end of the barrier wall by the recovery system.

Soil Remediation Strategy

- An institutional control (Deed Notice) for the entire Domestic Trade Terminal and Tankfield restricts this area to non-residential use only. The Deed Notice for the P66-owned portion

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of the BRC was filed and recorded with Union County and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.

- AOC specific controls (soil capping and sign) mitigate direct contact with soils and/or prevent the potential for migration of impacts to ground water. See **Figure 5.4-3** for location of AOC specific controls.
- Visual inspections of the AOC specific controls – Semiannually.
- Visual inspections of the sign associated with ECP – Quarterly.

AOC Specific Control – Installed Cap

- P66 continues to modify the paved surfaces in the area that also serves as a cap (replacing the current asphalt with 10-inch-thick concrete and an approximately 2-inch layer of stone sub-base beneath).

Results of Inspection

- Semiannual cap inspection requirements have been suspended while P66 makes amendments to the caps.
- Visual inspections of the sign associated with the ECP were completed in 1Q and 2Q and no disturbances to the sign were noted.

Recommendations and Path Forward

- Domestic Trade hydraulic control system – Continue operation.
- Ground water monitoring – Continue annual gauging.
- Ground water sampling – Continue annual sampling.
- Visual inspection of the cap – Once P66 upgrades are complete, visual inspections will be completed semiannually.
- Visual inspection of the sign associated with ECP – Continue quarterly.

Permits

- NJDEP Water Allocation Permit No. 2633P.

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Program Supporting Documentation and Prior Approvals

- The Domestic Trade Terminal and Tankfield remedial actions were constructed based on the NJDEP-approved June 29, 2004, RAWP and requisite addendums and modifications.
- Post-remedial monitoring and sampling events are completed based on the requirements of the RAR and comments from the NJDEP in their April 12, 2011, RAR approval letter.
- April 23, 2015, NJDEP approval of the 2H 2014 SAPR – Reduced Chlorinated Volatile Organic Compound (CVOC) sampling from annually to once every three years.
- July 5, 2017, NJDEP approval of the 2H 2016 SAPR – Reduced ground water monitoring and sampling from quarterly to annually in accordance with November 2009 RAR.
- May 3, 2018, NJDEP approval of the 2H 2017 SAPR – Discontinued CVOC sampling.
- The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019.

5.5 IAOC A14 - Greater Elizabeth Tankfield Soil Remediation Strategy Updates

Soil Remediation Strategy

- An institutional control (Deed Notice) for the Greater Elizabeth Tankfield restricts this area to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019, and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.
- AOC specific controls (soil capping and sign) mitigate direct contact with soils. See **Figure 5.5-1** for location of AOC specific controls.
- Visual inspections of the AOC specific controls – Semiannually.
- Visual inspections of the sign associated with ECP – Quarterly.

AOC specific control

- Permeable soil cap – A one-foot-thick layer of soil placed directly over the existing impacted soil.

Results of Inspection

- AOC specific controls (caps) were inspected in 1H. See **Figure 5.5-1** for results of inspection.
- Tire tracks and ruts were noted on the P66 installed cap. Additional sampling to evaluate if reduction or elimination of cap is possible is scheduled to be completed in 2H 2022.
- Visual inspections of the sign associated with the ECP were completed in 1Q and 2Q and no disturbance to the sign was noted.

Recommendations and Path Forward

- Visual inspections of AOC specific controls – Continue semiannually.
- Visual inspections of the sign associated with ECP – Continue quarterly.
- Complete additional sampling to evaluate if reduction or elimination of the need for the cap as an AOC specific control is possible. These activities are scheduled for 2H 2022.

5.6 IAOC D1 - Tremley Tankfield and IAOC D2 - Former Lower Tremley Tankfield Separator Remediation

The Tremley Tankfield (IAOC D1) and Former Lower Tremley Tankfield Separator (IAOC D2) are collectively referred to as the D-Unit Tremley Area and occupy approximately 116.5 acres of land on the southern portion of the BRC. IAOC D1 is an active tankfield and consists of a series of aboveground storage tanks and IAOC D2 has been used by P66 for materials storage and handling of various construction materials, although this area is currently vacant. The RAW for these IAOCs was submitted to the NJDEP on July 12, 2017, and subsequently approved by the NJDEP on March 14, 2018. The RAW proposed MNA for ground water and capping and restricted access via installation of a fence and signs as the remedial action for soil. Since the submittal and subsequent approval of the RAW by the NJDEP, an evaluation has been conducted to determine whether the proposed remedial actions for soil remain the most appropriate measures. Based on the May 21, 2019, approval of the Sitewide Engineering Control for Soils, alternative remedial actions for soils are planned to be proposed within a RAWA which will be submitted to the NJDEP.

Remedial Action Components

- An institutional control (Deed Notice) for the Tremley Tankfield and Former Lower Tremley Tankfield Separator restricts this area to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019, and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.
- The approved remedial action for soils consisted of AOC specific controls (existing surficial soil capping, fence installation around IAOC D2, and signs) to mitigate direct contact with soils and/or prevent the potential for migration of impacts to ground water. Based on current use of the area by P66, alternative soil remedial actions are planned to be proposed in a RAWA/RAR which is currently planned for submittal in 1H 2023.
- MNA for ground water with annual sampling addresses dissolved-phase COCs that exceed their respective NJDEP Class II-A GWRS.

Remedial Actions Completed During the Reporting Period

- MNA ground water sampling as per the 2017 approved RAW. The D1/D2 sampling program was updated in 2020 based on the NJDEP approved 2020 Site Wide Annual Overburden Ground Water Sampling Program.

Ground Water Analytical Results Summary

- The annual ground water sampling event results will be presented in the 2H 2022 SAPR.

Status at the End of the Reporting Period

- The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019, and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.
- Visual inspections of the signs associated with the ECP were completed in 1Q and 2Q and no disturbance to the signs was noted. See **Figure 5.6-1** for sign locations. Alternative soil remedial actions will be documented in a RAWA/RAR.
- MNA ground water sampling will continue to be conducted annually as part of the site-wide annual overburden ground water sampling program.

Remedial Actions to be Completed in the Next Reporting Period

- Alternative soil remedial actions (signs at the perimeter of IAOC D2 in lieu of the fence proposed in the RAW) were installed on February 25, 2021. The alternative soil remedial actions will be documented in a RAWA/RAR currently scheduled for submittal in 1H 2023.

Permits

- Not applicable.

Program Supporting Documentation and Prior Approvals

- March 14, 2018, NJDEP approval of the *Overburden Ground Water and Soil RAW*.
- The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019.
- October 7, 2020, NJDEP approval of the proposed modifications to the Site Wide Annual Overburden Ground Water Sampling Program.

5.7 IAOC D3a - Current and Former Diesel Tankfield and IAOC D4 - Tank 519 Creek Dredging Area Soil Remediation Strategy Updates

Soil Remediation Strategy

- An institutional control (Deed Notice) for the Current and Former Diesel Tankfield restricts this area to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019, and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.
- AOC specific controls (soil capping and signs) mitigate direct contact with soils and/or prevent the potential for migration of impacts to ground water. See **Figure 5.7-1** for location of AOC specific controls.
- Visual inspections of the AOC specific controls – Semiannually.
- Visual inspections of the signs associated with ECP – Quarterly.

Current and Former Diesel Tankfield

- AOC specific controls (soil capping):
 - Twelve inches of clean soil/stone underlain by a permeable filter fabric (geotextile demarcation layer).
 - Additional soil or stone/aggregate was added, as needed, to achieve the minimum cap thickness.

Tank 519 Creek Dredging Area

- AOC specific control (signs):
 - Thirteen signs installed around the berm area.

Results of Inspections

- AOC specific controls (caps) were inspected in 1H. See **Figure 5.7-1** for results of inspection.

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- Residual debris from Hurricane Ida was observed on the southern portion of the installed cap; however, no erosion or concern of cap integrity was noted.
- Visual inspections of the sign associated with the ECP were completed in 1Q and 2Q and no disturbances to the signs were noted.

Recommendations and Path Forward

- Visual inspections of AOC specific controls – Continue semiannually.
- Visual inspections of the signs associated with ECP – Continue quarterly.
- Prepare the Current and Former Diesel Tankfield and Tank 519 Creek Dredging Area Soil RAR.

5.8 IAOC D6 - Western Shore of Reservoir (IAOC D6) Remediation

The *Focused Feasibility Study Report/Remedial Action Workplan* (FFSR/RAW) for this IAOC was submitted to the NJDEP on September 21, 2017, and subsequently approved by the NJDEP on August 6, 2020. The RAW proposed MNA for ground water and a fence as the AOC specific control for soil. A RAR which documented the remedial actions for soil and ground water in IAOC D6 was submitted to the NJDEP on October 12, 2021. A response from the NJDEP is pending as of the date of this report.

Remedial Action Components

- An institutional control (Deed Notice) for the Western Shore of the Reservoir restricts this area to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019, and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.
- AOC specific controls (existing fence around IAOC D6 and signs) will mitigate direct contact with soils. See **Figure 5.8-1** for sign locations.
- MNA for ground water with annual sampling addresses dissolved-phase COCs that exceed their respective NJDEP Class II-A GWRS.

Program Requirements Met

- Visual inspections of the existing refinery fence and installed signs were completed in 1Q and 2Q and no disturbances to the fencing or signs were noted.
- MNA ground water sampling was completed during this reporting period in conjunction with the site-wide annual overburden ground water sampling program.

Ground Water Analytical Results Summary

- MNA ground water sampling was completed during this reporting period in conjunction with the site-wide annual overburden ground water sampling program and will be summarized in the 2H 2022 SAPR.

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Recommendations and Path Forward

- MNA Ground water sampling – Continue annually as part of the site-wide annual overburden ground water sampling program.

Program Supporting Documentation and Prior Approvals

- August 6, 2020, NJDEP approval of the FFSR/RAW.
- The D6 RAR was submitted to the NJDEP on October 12, 2021. A response is pending as of the end of this reporting period.

5.9 IAOCs E2, E3, E4, and E5 - Four-Landfill Area

Ground Water Remediation Strategy Program Requirements

- Perimeter containment and hydraulic control of dissolved-phase COCs and LNAPL-impacted ground water to prevent potential impact to surface water or migration to offsite properties.
- Control and recovery of LNAPL present in the Southern Landfill (IAOC E5).
- Ground water monitoring – Quarterly.
- Ground water sampling – Quarterly.

Ground Water Remediation Strategy Program Requirements Met

- Overall, the program requirements were met during the reporting period. See below for details regarding LNAPL in piezometer EPZ-104S which is located outside of the hydraulic barrier wall.

Ground Water Monitoring Summary

- Quarterly ground water monitoring events were completed on February 10 and June 8, 2022 (**Table 5.9-1**, and **Figures 5.9-1** and **5.9-2**). Select wells in adjacent IAOCs were monitored in conjunction with those in IAOCs E2, E3, E4, and E5, and were used to determine ground water elevations, contours, and flow directions. The ground water monitoring data from these wells is included in **Table 5.9-1** and on **Figures 5.9-1** and **5.9-2**.
- LNAPL detections during the quarterly monitoring events ranged from a film in several wells to an apparent thickness of 1.25 feet in monitoring well GMW-108 (1Q) (**Table 5.9-1**), which are consistent with historical LNAPL detections in the Four-Landfill Area. The LNAPL thickness in piezometer EPZ-115 could not be measured during the 1Q event because the viscous LNAPL fouled the probe and did not allow for an accurate depth to ground water measurement. Therefore, the corrected ground water elevation is lower than or equal to the elevation presented on the figure and table. Apart from LNAPL detected in piezometer EPZ-104S and well L-8 during both quarterly events, the LNAPL detections in the Four-Landfill Area were in wells or monitoring points located inland of the barrier walls.
- Piezometer EPZ-104S is a 1-inch diameter monitoring point located outside of the barrier wall in IAOC E4. In response to the detection of LNAPL in the piezometer during historical monitoring events, monthly gauging events were completed for EPZ-104S in 1H (**Table 5.9-2**). Monitoring well L-8 is a 4-inch diameter well located outside of the barrier wall in

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IAOC E3. Monitoring well L-8 was added to the monthly gauging schedule in February 2022 following the detection of a LNAPL film in the well during the 1Q gauging event. Apparent LNAPL thicknesses measured in EPZ-104S during the supplemental gauging events ranged from a film to 0.07 feet, while LNAPL was detected as a film in well L-8 during each event. As detailed on **Table 5.9-2**, LNAPL recovery events utilizing a vacuum truck were completed for both locations during the reporting period. The two wells will continue to be monitored monthly, with LNAPL recovery events completed on an as-needed basis in accordance with the Road Map.

- Supplemental gauging and LNAPL recovery events were completed for ground water monitoring wells GMW-108, GMW-280, GMW-281, and GMW-282 in IAOC E5 (**Table 5.9-2**). Apparent LNAPL thicknesses recorded during the gauging events ranged 0.04 feet in GMW-282 to 2.09 feet in GMW-108, consistent with historical data. LNAPL recovery via vacuum truck was completed at the four wells during each month of the reporting period.

Ground Water Analytical Results Summary

- The 1Q groundwater and system sampling event was conducted between February 16 and March 3, 2022. The 2Q groundwater and system sampling event was conducted between May 2 and May 10, 2022 (**Tables 5.9-3** through **5.9-5** and **Figure 5.9-3**).
- COCs detected at concentrations above the NJDEP Class II-A GWQS during the 1Q and/or 2Q groundwater and system sampling events include benzene, trichloroethylene, 1,4-dioxane, 1,2-dibromo-3-chloropropane, benzo[a]anthracene, benzo[a]pyrene, benzo[b]fluoranthene, indeno[1,2,3-c,d]pyrene, SVOC & VOC TICs, arsenic, chromium, lead, and nickel. These exceedances were detected in monitoring wells located on the interior of the hydraulic barrier wall in the four-landfill area, with the exceptions as below:

IAOC E2

- GMW-193
 - Benzene concentrations were below the NJDEP Class II-A GWRS in 1Q but exceeded the NJDEP Class II-A GWRS in 2Q. These concentrations are consistent with historical detections.
- GMW-247
 - 1,4-Dioxane (1Q), total SVOC TICs (1Q and 2Q), and total arsenic (1Q) concentrations exceeded the NJDEP Class II-A GWRS. These concentrations are consistent with historical detections.

IAOC E3

- L-12C
 - Total arsenic and total lead concentrations were below the NJDEP Class II-A GWRS in 1Q but exceeded the NJDEP Class II-A GWRS in 2Q. These concentrations are consistent with historical detections.
- L-14C
 - Total SVOC TICs concentrations were below the NJDEP Class II-A GWRS in 1Q but exceeded the NJDEP Class II-A GWRS in 2Q. This concentration is not consistent with historical detections and will continue to be monitored in this well.
- Monitoring wells L-13C, GMW-245, and GMW-282 were not sampled due to the presence of LNAPL detected during 1Q and 2Q. This is consistent with historical conditions in these wells.
- The 1-inch diameter piezometers EPZ-106, EPZ-108, EPZ-113, EPZ-114 in IAOC E2; EPZ-101, EPZ-105, EPZ-115 in IAOC E3; EPZ-112 in IAOC E4 and EPZ-109, EPZ-110, EPZ-11 in IAOC E5; were temporarily removed from the sampling program in 1H due to difficulty in sampling these points due to their small diameter.
- Ground water sampling logs and confirmation emails of EDD submissions are provided electronically on the attached CD (**Attachment A-6**).
- An evaluation of the field and analytical data gathered since the Four-Landfill Area system became operational was performed in 2Q. The results of the evaluation and recommendations for modifications to the ground water sampling program were submitted to the LSRP on July 7, 2022. The proposed modifications were approved by the LSRP on July 21, 2022, and submitted to the NJDEP SRP Case Manager on July 27, 2022. The proposed modifications to the ground water sampling program will be implemented beginning in 3Q 2022 and the results will be presented in the 2H 2022 SAPR.

System Components

- Hydraulic barrier wall – The barrier wall consists of approximately 4,342 total linear feet of cement-bentonite slurry wall and 275 total linear feet of steel sheet pile wall keyed into glacial till. There are seven sections of slurry wall and three sections of steel sheet pile wall, with gaps of various width between the sections where utility crossings and refinery infrastructure prevented the installation of additional barrier wall.
- LNAPL recovery trench – The LNAPL recovery trench is an approximately 200-foot-long trench backfilled with gravel that is designed to facilitate LNAPL recovery within a portion of IAOC E5.
- Hydraulic control and LNAPL recovery system – The system consists of pneumatic pumps operated within a network of 24 recovery wells located inland of the barrier wall and near

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gaps within or at the ends of the barrier wall sections, and four recovery sumps installed within the LNAPL recovery trench. Recovered total fluids are processed through an oil/water separator prior to the ground water being discharged to the P66 WWTP via the SLOU Force Main and the LNAPL being transported to the P66 WWTP via vacuum truck.

System Performance

- System runtime was approximately 90% during the reporting period. The longest period of downtime was between February 11 and 14, 2022, and was attributed to a high oil temperature alarm for the system air compressor. Additional downtime events during the period consisted of multiple short-duration shutdowns for routine maintenance and alarm activations, the majority of which were less than 24 hours in duration.
- Based on discharge totalizer readings, approximately 3,803,796 gallons of ground water were recovered during the reporting period and discharged to the P66 WWTP. The system flow rate averaged approximately 16.1 gpm during operation.
- The volume of LNAPL recovered by the system and transferred to the P66 WWTP was estimated at approximately 166 gallons during the reporting period. Since startup in July 2018, it is estimated that nearly 7,380 gallons of LNAPL have been recovered by the system.
- The 24 recovery wells and three of the four LNAPL recovery trench sumps were operational during the reporting period (sump RS-E1 was taken offline in 2H 2021); however, routine inspections throughout the period identified select pumps that required maintenance to address typical fouling issues, resulting in limited-duration deactivations of individual recovery pumps.
- Similar to the removal of the pump from sump RS-E1 as reported during the 2H 2021 SAPR, the pump in LNAPL recovery trench sump RS-E3 was removed in June 2022. Sumps RS-E1 through RS-E4 were originally designed to be installed to the same terminal elevation; however, as-built elevations vary and recovery sump RS-E1 is the shallowest of the four sumps, followed by RS-E3. The four sumps are hydraulically connected through the clean stone backfill used to construct the recovery trench. During system operation, the trench will dewater until liquid levels reach the inlet of the pump in recovery sump RS-E2, the deepest of the sumps. Gauging data collected over the first four years of system operation confirms that liquid levels within the trench were consistently lower than the RS-E1 and RS-E3 pump inlets and that operation of the pumps is not critical to meeting remedial objectives. The need to reinstall a pump in recovery sump RS-E1 or RS-E3 will be reassessed, if appropriate, based on future trends or observations.
- To better contain and recover LNAPL that has historically been detected near gaps in the hydraulic barrier wall, the bottom-loading pumps were replaced with top-loading pneumatic pumps in recovery wells RW-E3 (May 31, 2022), RW-E4 (January 17, 2022), RW-E12 (June 2, 2022), RW-E17 (June 2, 2022), and RW-E24 (May 31, 2022) during this reporting period.

Hydraulic Control Summary

- Ground water elevation contour maps prepared for the 1Q and 2Q gauging events (**Figure 5.9-1** and **Figure 5.9-2**, respectively) demonstrate the following conditions and confirm that hydraulic control is being maintained by the system along the barrier walls in IAOC E2, E3, E4, and E5:
 - Ground water flow toward the barrier walls and recovery wells from inland areas;
 - Inward hydraulic gradients toward recovery wells at gaps and ends of walls; and
 - At gaps near surface water, ground water elevations in recovery wells or piezometers located closest to the gap were either below the adjacent surface water elevation or below the elevation of ground water in piezometers installed in the gap.
- Localized ground water mounding was observed during both events near monitoring wells L-9 and L-17C that appears to direct a portion of ground water flow in this area to the south toward IAOC E1. This observation is consistent with previous gauging events.

Soil Remediation Strategy

- An institutional control (Deed Notice) for the Four-Landfill Area (IAOCs E2 through E5) restricts this area to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019, and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.
- AOC specific controls (soil capping and sign) mitigate direct contact with soils and/or prevent the potential for migration of impacts to ground water. See **Figure 5.9-4** for location of AOC specific controls.
- The IAOCs E2 through E5 soil cap design and construction comply with the substantive requirements of the New Jersey Solid Waste Regulations, closing and providing final cover for the former landfill units. The IAOC E3 cap provides closure for the former Resource Conservation and Recovery Act (RCRA) Landfarm Waste Management Area (Landfarm) unit operated above a portion of the former IAOC E3 landfill unit.
- Visual inspections of the AOC specific controls – Semiannually.
- Visual inspections of the signs associated with ECP – Quarterly.

IAOC E2 and Southern Portion of IAOC E3 Cap

- The cap for IAOC E2 and the portion of IAOC E3 south of the Boat Lines is a soil cover system constructed with a minimum of 18 inches of cover soil overlain by a minimum of six inches of topsoil. The cover soil is a low-permeability soil with a hydraulic conductivity of less than 1×10^{-5} centimeters per second (cm/sec). The topsoil is planted with grasses and serves as an erosion control layer.
- Roadways within the capped area are constructed directly on the cover soil layer. An 8-ounce non-woven geotextile overlain with Tensar TX 5 geogrid is installed on the cover soil material, and American Association of State Highway and Transportation Officials (AASHTO) No. 1 Stone is present over the geotextile and geogrid with a compacted thickness of 10 inches. The AASHTO No. 1 Stone is topped with 2 inches of AASHTO No. 57 Stone.

Former Landfarm Portion of IAOC E3 Cap

- The cap for the portion of IAOC E3 formerly operated as a RCRA Landfarm unit is a geosynthetic liner overlain by soil cover system. The impermeable barrier layer is a 40-mil (0.04-inch) linear low-density polyethylene (LLDPE) textured geomembrane liner with welded joints. The LLDPE liner is overlain by an 8-ounce non-woven geotextile protection layer and is sealed to all penetrations. A soil cover system is maintained above the liner and protection layer consisting of a minimum of 18 inches of cover soil overlain by a minimum of six inches of topsoil. The cover soil is a low-permeability soil with a hydraulic conductivity of less than 1×10^{-5} cm/sec. The topsoil is planted with grasses and serves as an erosion control layer.
- A gas conveyance geocomposite layer was installed under portions of the LLDPE liner system as a protective measure. Thirteen passive vents are present in the IAOC E3 cap that connect into this conveyance layer. The conveyance layer and passive vents were installed as a conservative measure in the event that landfill gases are being generated in volumes that could damage the liner system. The vent pipes have remained capped since their installation and are monitored for pressure buildup to determine if their operation is required or if they can be abandoned. To date, no evidence of gas accumulation or pressure beneath the liner has been observed.
- Roadways within the capped area are constructed directly on the cover soil layer. An 8-ounce non-woven geotextile overlain with Tensar TX 5 geogrid is installed on the cover soil material, and AASHTO No. 1 Stone is present over the geotextile and geogrid with a compacted thickness of 10 inches. The AASHTO No. 1 Stone is topped with 2 inches of AASHTO No. 57 Stone.

IAOC E4 Cap

- The cap for IAOC E4 is a soil cover system constructed with a minimum of 18 inches of cover soil overlain by a minimum of six inches of topsoil. The cover soil is a low-permeability soil with a hydraulic conductivity of less than 1×10^{-5} cm/sec. The topsoil is planted with grasses and serves as an erosion control layer.
- Roadways within the capped area are constructed directly on the cover soil layer. An 8-ounce non-woven geotextile overlain with Tensar TX 5 geogrid is installed on the cover soil material, and AASHTO No. 1 Stone is present over the geotextile and geogrid with a compacted thickness of 10 inches. The AASHTO No. 1 Stone is topped with 2 inches of AASHTO No. 57 Stone.

IAOC E5 Cap

- The cap for IAOC E5 is a soil cover system constructed with a minimum of 18 inches of cover soil overlain by a minimum of six inches of topsoil. The cover soil is a low-permeability soil with a hydraulic conductivity of less than 1×10^{-5} cm/sec. The topsoil is planted with grasses and serves as an erosion control layer.
- Roadways within the capped area are constructed directly on the cover soil layer. An 8-ounce non-woven geotextile overlain with Tensar TX 5 geogrid is installed on the cover soil material, and AASHTO No. 1 Stone is present over the geotextile and geogrid with a compacted thickness of 10 inches. The AASHTO No. 1 Stone is topped with 2 inches of AASHTO No. 57 Stone.

Results of Inspections

- During this reporting period, limited areas of road gravel washout, distressed vegetation, and rutting were noted on the cap in IAOCs E2, E4, and E5. See **Figure 5.9-4** for results of the inspection. The issues noted during the 1H 2022 inspections will continue to be monitored and addressed as appropriate.
- Visual inspections of the installed signs were completed in 1Q and 2Q and no disturbances to the signs were noted.

Recommendations and Path Forward

- Hydraulic control and LNAPL recovery system – Operate while continuing to optimize performance.
- Ground water monitoring – Continue quarterly.

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- Ground water sampling – Continue in accordance with the modified ground water sampling program that was approved by the LSRP on July 21, 2022.
- Visual inspections of the AOC specific controls – Continue semiannually.
- Visual inspections of the signs associated with ECP – Continue quarterly.

Permits

- NJDEP Water Allocation Permit No. 2633P.

Program-Supporting Documentation and Prior Approvals

- September 10, 2013, NJDEP approval of the May 2013 *Final Amended Landfarm Closure Plan*.
- July 11, 2014, NJDEP approval of the 2014 Four-Landfill RAW and response to NJDEP comments.
- July 28, 2017, NJDEP approval of the 2017 E-Unit Landfills (IAOCs E3, E4, and E5) RAWA and response to NJDEP comments.
- May 16, 2018, LSRP approval of the clay fill material utilized in the Southern Landfill (IAOC E5) cover system construction (material chemical analysis indicated an exceedance of the NJDEP Impact to Ground Water Soil Screening Level for aluminum) via email.
- May 17, 2018, LSRP approval of the modified barrier wall design (i.e., steel sheet pile wall section) for the Western Landfill (IAOC E4).
- May 18, 2018, NJDEP approval of the 2018 Eastern Landfill (IAOC E2) RAWA and response to NJDEP comments.
- The Deed Notice for the P66-owned portion of the BRC, filed and recorded with Union County on December 18, 2019.
- The RAR was submitted to the NJDEP on December 11, 2020. A response to the RAR is pending as of the end of this reporting period.
- The Landfarm Closure Report (LCR) for the Central Landfill / Landfarm (IAOC E3) was submitted to the NJDEP on January 14, 2021. A response to the LCR is pending as of the end of this reporting period.
- July 21, 2022, LSRP approval of the modified ground water sampling program for the Four Landfill Area.

5.10 IAOC F2 - Former 40-Acre Tankfield Separator and IAOC F3 - 40-Acre Tankfield Undeveloped Property Remediation

Program Requirements

- MNA for ground water with quarterly sampling addresses dissolved-phase COCs that exceed their respective NJDEP Class II-A GWRS.
- Capping systems (natural or engineered) are no longer required to be maintained by ExxonMobil based on the NJDEP's March 16, 2018, approval of the *IAOC F1 and F2 Capping Evaluation*. An institutional control (Deed Notice) for the 40-Acre Tankfield restricts this area to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019, and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.

Program Requirements Met

- The program requirements were met during the reporting period as detailed below.

Ground Water Analytical Results Summary

- Quarterly MNA ground water monitoring program (**Table 5.10-1**).
- Quarterly MNA ground water sampling (**Table 5.10-2** and **Figure 5.10-1**).
 - Arsenic was detected at concentrations above the NJDEP Class II-A GWRS in FA-1S and GMW-253 but are less than 10 times NJDEP Class II-A GWRS and remain consistent with historical concentrations. A site-wide arsenic evaluation was conducted, and an *Arsenic in Sitewide Soil and Ground Water Evaluation and Recommendation* letter as submitted to the NJDEP on October 21, 2021. Following the NJDEP's review of this letter, a ground water sampling plan for arsenic analysis will be proposed for the LSRP and NJDEP's review.
 - Analytical results from 2H 2020 through 1H 2022 sampling events are shown in **Table 5.10-2**.
- Because offsite residential properties are located adjacent to this portion of the BRC, the ground water analytical results were also compared to the NJDEP Vapor Intrusion Ground Water Screening Levels. Targeted analytes do not exceed the NJDEP Vapor Intrusion Ground Water Screening Levels.

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- An absorbent sock is present in GMW-142 to address LNAPL which has historically been detected in this well. The last occurrence of LNAPL in GMW-142 was a film that was detected on February 22, 2022. The absorbent sock in GMW-142 was replaced during the quarterly sampling event on February 22, 2022.
- An absorbent sock is present in GMW-300 to address the LNAPL in GMW-300 on August 26 and October 28, 2021. The absorbent sock was replaced during the quarterly sampling event on May 19, 2022.
- Ground water sampling logs and confirmation emails of EDD submissions are provided electronically on the attached CD (**Attachment A-7**).

LNAPL Recovery Summary/Path Forward

- Replace absorbent socks as needed.
- Based on the presence of LNAPL detected in GMW-142 and GMW-300 and historical total petroleum hydrocarbon concentrations in soil in the area of these wells, a soil sampling program was initiated in June 2022. The results of this investigation will be summarized in a separate deliverable.

Recommendations and Path Forward

- MNA Ground water sampling – Continue quarterly.

Program Supporting Documentation and Prior Approvals

- February 22, 2012, NJDEP approval of the Revised F1/F2 RAW.
- July 30, 2014, NJDEP approval of the F3 (40-Acre Undeveloped Property) Revised FFSR/RAW.
- August 31, 2015, NJDEP approval of the F1/F2 soil RAR.
- October 8, 2015, NJDEP approval of the 1H 2015 SAPR.
- March 16, 2018, NJDEP approval of the *IAOC F1 and F2 Capping Evaluation*.
- December 18, 2019, filing and recording of the Deed Notice for the P66-owned portion of the BRC with Union County.
- December 8, 2020, NJDEP approval of the 1H 2020 SAPR and the *Support and Clarification of Recommended Actions* document.

5.11 IAOC L - Sludge Lagoon Operable Unit Remediation

Ground Water Remediation Strategy Program Requirements

- The NJDEP-mandated objectives of the SLOU Remedial Action are as follows:
 - Achieve an inward horizontal hydraulic gradient from outside the slurry and steel sheet pile barrier wall (barrier wall) towards the SLOU extraction system.
 - Achieve an upward vertical hydraulic gradient from the bedrock underlying the SLOU.
 - Lower the ground water level within the SLOU below the solidified sludge.
- Ground Water Monitoring:
 - Monitor the inward hydraulic gradient monitoring well pairs and the upward vertical gradient monitoring well pair – Semiannually.
 - Evaluate ground water levels below the bottom of the solidified sludge – Annually.
- Ground Water Sampling – Annually.

Ground Water Remediation Strategy Program Requirements Met

- The program requirements were met during the reporting period as detailed below.

Ground Water Monitoring Summary

- The ground water monitoring event was completed on January 12, 2022 (**Table 5.11-1**). Wells GMW-613, GMW-621, and GMW-623, were not accessible during the event. GMW-623 was buried under gravel and ice in the roadway and GMW-613 and GMW-621 were not accessible due to ice and snow. SLOU-P-4 and SLOU-P-25 were not gauged due to an obstruction in the well.
- LNAPL detections during the gauging event were consistent with historical detections and ranged from a film in several monitoring wells to an apparent thickness of 4.34 feet in well SLOU-P-18. In addition, the viscosity of the LNAPL also resulted in fouling of the probe and prevented the accurate measurement of the depth to ground water and LNAPL thickness in sixteen monitoring wells. Therefore, the corrected ground water elevations provided for these wells on **Table 5.11-1** are approximate values based on the depth to LNAPL, with the actual elevations lower than or equal to the elevations shown. Excluding the LNAPL detection in monitoring well GMW-615 (0.02 feet), the LNAPL detections were in wells located inside of the perimeter barrier wall.

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- Monitoring wells GMW-39 (located in Tremley Tankfield – IAOC D1) and GMW-615 have historically contained or currently contain LNAPL and are located outside of the SLOU barrier wall. Supplemental gauging is performed on these wells, with LNAPL recovery events completed as appropriate (**Table 5.11-2**). An absorbent sock is currently maintained in monitoring well GMW-39, while LNAPL is recovered from monitoring well GMW-615 using a vacuum truck. During this reporting period, LNAPL ranged from non-detect to a film in monitoring well GMW-39, while LNAPL detections ranged from a film to an apparent thickness of 0.28 feet in monitoring well GMW-615. The absorbent sock in monitoring well GMW-39 was inspected during each gauging event but did not require replacement, and three vacuum extraction events were completed to recover LNAPL from monitoring well GMW-615. Monthly gauging and inspection events are scheduled to continue in 2H 2022.

Ground Water Analytical Results Summary

- Annual results will be presented in the 2H 2022 SAPR.

System Components

- Hydraulic barrier wall – The barrier wall consists of an approximately 6,140-foot-long soil-bentonite slurry and steel sheet pile barrier wall keyed into glacial till. The barrier wall is continuous and encircles the area of solidified sludge within the SLOU area.
- Hydraulic control system – The system is comprised of 21 extraction wells equipped with electric positive displacement pumps designed for total fluids recovery. The extraction wells are installed within a perimeter collection trench located inside of the hydraulic barrier wall. Recovered total fluids are processed through an equalization tank and an oil/water separator prior to the ground water being discharged to the P66 WWTP via the SLOU Force Main and the LNAPL being transported to the P66 WWTP via vacuum truck.

System Performance

- System runtime was approximately 98% during the reporting period. Downtime events consisted of multiple short-duration shutdowns for routine maintenance and alarm activations, most of which were less than 24 hours in duration.
- Based on flow totalizer readings, approximately 1,234,090 gallons of total fluids were collected from the perimeter system during the reporting period and discharged to the P66 WWTP. The system flow rate averaged approximately 4.8 gpm during operation.
- Eighteen of the twenty-one recovery wells were operational during the reporting period. Routine inspections throughout the period identified select pumps that required maintenance, resulting in limited-duration deactivations of individual recovery pumps.

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Pumps that were offline for extended periods during the reporting period included the following:

- As detailed in the 2H 2020 SAPR, operation of extraction well EX-A1 is not necessary for the system to achieve its remedial objectives. Therefore, this well remained offline throughout 1H 2022. The need to resume extraction from EX-A1 will be reassessed, if appropriate, based on future trends or observations.
- A control issue for the pump at extraction well EX-B1 was identified in July 2021 and the extraction well remained offline throughout this reporting period. It was determined that the level controller had failed and required replacement, and that the original controller is no longer manufactured. Working with the manufacturer, an alternative option was identified, procured, and programmed. Installation of the new controller was initiated in late 2Q 2022; however, additional programming issues were identified that require further assistance from the manufacturer. The restart of extraction well EX-B1 is anticipated for 2H 2022.
- A control issue for the pump at extraction well EX-C1 was identified in September 2021 and the extraction well remained offline throughout this reporting period. The issue is believed to be associated with the variable frequency drive (VFD) for the pump. A replacement VFD was purchased; however, production delays at the manufacturer resulted in the VFD delivery being delayed until late June 2022. The VFD installation and restart of extraction well EX-C1 is scheduled for July 2022.

Hydraulic Control – Goal Evaluation

- An inward hydraulic gradient, as demonstrated from gauging data collected from select monitoring well pairs located inside and outside of the SLOU barrier wall, was achieved at nine well pairs during the semiannual gauging event (**Table 5.11-1**). Wells GMW-613 and GMW-623 were inaccessible during the gauging event; therefore, the inward hydraulic gradient could not be evaluated for the two remaining well pairs (GMW-612/GMW-613 and GMW-622/GMW-623).
- An upward vertical hydraulic gradient between monitoring wells GMW-37 and GMW-37B was achieved as demonstrated by the January 12, 2022, gauging data (**Table 5.11-1**). The corrected ground water elevation was observed to be 2.63 feet higher in the bedrock aquifer well (GMW-37B) as compared the overburden aquifer well (GMW-37). This upward vertical gradient minimizes the potential for the sludge to infiltrate into the bedrock aquifer or aquifers outside of the barrier wall.
- Ground water elevations assessed during the January 12, 2022, gauging event were compared to the reported bottom elevation of the solidified sludge in the vicinity of overburden wells located inside of the SLOU barrier wall. A total of 108 wells are typically utilized for the evaluation; however, two wells were inaccessible during the January 12,

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2022, event (SLOU-P-4 and SLOU-P-25). Of the 106 wells gauged during the event, ground water elevations were calculated or estimated to be below the solidified sludge in 94 of the wells (89%) (**Figure 5.11-1**).

- The current program requirements include annual ground water elevation contouring. Ground water elevation contours are typically prepared for IAOCs with active recovery systems to assist with the evaluation and demonstration of hydraulic control, particularly at gaps or the ends of the barrier walls. The SLOU area is fully encircled by a soil-bentonite slurry and steel sheet pile barrier wall that was constructed without gaps. The NJDEP-approved monitoring program for hydraulic control in the SLOU area includes semiannual gauging of 11 well pairs to evaluate inward gradient, semiannual gauging of one well pair to evaluate upward gradient, and annual gauging of 108 ground water monitoring wells to compare ground water elevations to the reported bottom of solidified sludge elevations, as detailed in the previous three bullets. While ground water elevation contours have historically been included in the SAPRs, they were not included in the three NJDEP-approved criteria used to demonstrate achievement of hydraulic conditions stated above in the Ground Water Remediation Strategy Program Requirements section. Because the SLOU area is entirely surrounded by a hydraulic barrier wall, a contour map was not prepared for the annual gauging event completed in January 2022 and it is proposed that the annual contouring requirement be eliminated. No changes to the ground water monitoring schedule or remedial objective evaluation approach are proposed.

Hazardous Waste Management

- 19 drums of SLOU oil water separator (OWS) Media and one drum containing personal protective equipment (PPE) used in the SLOU area was transported offsite for disposal on March 2, 2022. The hazardous waste disposal manifest is included in **Appendix C**.

Soil Remediation Strategy

- An institutional control (Deed Notice) for the SLOU restricts this area to non-residential use only. The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019, and the SRAP application was submitted to the NJDEP on August 6, 2020. Based on discussions between the LSRP, ExxonMobil, and the NJDEP, a request to withdraw the SRAP application was submitted to the NJDEP by the LSRP on August 17, 2021. A revised SRAP application will be submitted at a later date, pending additional consultations with the NJDEP.
- AOC specific controls (soil capping and sign) mitigate direct contact with soils and/or prevent the potential for migration of impacts to ground water. See **Figure 5.11-2** for location of AOC specific controls.
- Visual inspections of the AOC specific controls – Semiannually.

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- Visual inspections of the signs associated with ECP – Quarterly.

AOC Specific Control – Installed Cap/Cover Enhancement

- Eighteen inches of low-permeability (10^{-5} cm/sec) soil free of organic matter with minimum of 30% fines and maximum particle size of 3 inches overlain by 6 inches of topsoil with vegetation throughout the SLOU.
- Twelve inches of clayey soil overlain by 6 inches of filter fabric installed along portion of the perimeter of the SLOU.
- LLDPE liner overlain with artificial turf. A half inch layer of sand ballast was placed atop the artificial turf.

Results of Inspection

- AOC specific controls (caps) were inspected in 1H 2022. Deficiencies requiring repairs were not noted during the inspection.
- Visual inspections of the signs associated with the ECP were completed in 1Q and 2Q and no disturbances to the signs were noted.

Recommendations and Path Forward

- SLOU hydraulic control system – Continue operation. Continue troubleshooting and repair of the pump for extraction well EX-B1.
- Ground water monitoring for inward and upward gradient – Continue semiannually.
- Ground water monitoring for levels below bottom of solidified sludge – Continue annually.
- Ground water sampling – Continue annually.
- Visual inspections of turf integrity including connection points around monitoring wells and grounding rods – Continue semiannually.
- Field reconnaissance with turf installation manufacturer scheduled for 3Q 2022.
- Visual inspections of the signs associated with ECP – Continue quarterly.
- Discontinue ground water elevation contouring as described above.

Permits

- NJDEP Water Allocation Permit No. 2633P.

Program Supporting Documentation and Prior Approvals

- Long-term maintenance and monitoring actions are consistent with the approach presented in the 2003 *RAR for the Bayway SLOU Remediation Project*.
- The SLOU remedial actions were constructed based on the *SLOU Interim Corrective Action Report* (ICAR), which was submitted to the NJDEP on December 29, 2011.
- The post-remedial monitoring and sampling have been completed based on the requirements of the 2009 SLOU ICAR.
- November 7, 2016, NJDEP approval of the *SLOU Corrective Action Report* included an approval of the SLOU objectives and evaluation criteria.
- April 27, 2017, NJDEP comments on the 2H 2016 SAPR approved the reduction of ground water monitoring of monitoring wells, piezometers, and sumps located in the extraction trench (other than SLOU inward hydraulic gradient pairs, the upward vertical gradient pair, and the interior LNAPL monitoring wells) from monthly to semiannually.
- The Deed Notice for the P66-owned portion of the BRC was filed and recorded with Union County on December 18, 2019.
- The July 7, 2020 email to the NJDEP and the 1H 2020 SAPR proposed reductions in frequency for the following requirements: monitoring for inward and upward gradient (reduced from quarterly to semiannually), ground water elevation contouring (reduced from semiannually to annually), ground water sampling (reduced from semiannually to annually), LNAPL recovery activities for monitoring wells located inside the barrier wall (eliminated), and visual inspection of turf integrity including connection points around monitoring wells and grounding rods (reduced from quarterly to semiannually). In addition, ground water monitoring well pair GMW-600 and GMW-601 were removed from the list of well pairs utilized to evaluate inward gradient. These proposed reductions were approved by the NJDEP in the September 22, 2020, email from the NJDEP and the December 8, 2020, NJDEP approval of the 1H 2020 SAPR.

5.12 Site-Wide Annual LNAPL Monitoring

Program Requirements

- A comprehensive site-wide gauging event implemented annually.

Program Requirements Met

- Not applicable.

Ground Water Monitoring Summary

- Annual ground water monitoring event – To be presented in the 2H 2022 SAPR.

Recommendations and Path Forward

- Ground water monitoring – Continue to gauge site-wide wells annually – To be presented in the 2H 2022 SAPR.
- LNAPL recovery to be achieved via remedial systems and various site-wide LNAPL recovery evaluations – To be presented in the 2H 2022 SAPR.

Program Supporting Documentation and Prior Approvals

- December 22, 2011, NJDEP approval of the 2010 LNAPL Report established a comprehensive site-wide gauging event that is conducted annually.
- April 30, 2021, NJDEP approval of the 2H 2020 SAPR approved the removal of GMW-26 and GMW-134 from the program.

5.13 Site-Wide Annual Overburden Ground Water Sampling Program

Program Requirements

- A site-wide sampling event at select monitoring wells across the BRC implemented annually.
- Compare the analytical results of the site-wide annual overburden ground water sampling event to the results of the baseline sampling event.
- Evaluate potential contribution of ongoing facility operations to current conditions.
- Establish a comprehensive network of monitoring wells (sentinel wells) that are predominantly located at perimeter areas of the BRC, adjacent to potential receptors or the property boundary.
- Monitor changes in ground water quality over time and potential impact to receptors.

Program Requirements Met

- Not applicable.

Ground Water Analytical Results

- Annual ground water sampling event – To be presented in the 2H 2022 SAPR.

Recommendations and Path Forward

- Annual ground water sampling event – To be presented in the 2H 2022 SAPR

Program Supporting Documentation and Prior Approvals

- August 12, 2013, LSRP and NJDEP approval of the *Revised Site-Wide Annual Overburden Ground Water Sampling Work Plan*, which was prepared and proposed in accordance with the June 2012 Road Map (Revision 1).
- December 9, 2014, NJDEP approval of the 1H 2014 SAPR – Monitoring wells GMW-102, GMW-205, GMW-214, GMW-240, and GMW-247 were replaced by GMW-78, GMW-70, GMW-157, GMW-276, and GMW-192, respectively.
- April 23, 2015, NJDEP approval of the 2H 2014 SAPR – Monitoring wells GMW-7-99 and GMW-8 were replaced by GMW-7 and GMW-199, respectively.

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- July 5, 2017, NJDEP approval of the 2H 2016 SAPR – Monitoring well GMW-232 was replaced by monitoring well GMW-267 in the site-wide sampling plan.
- Consistent with Revision 5 of the Road Map, the analytical results of the site-wide annual overburden ground water sampling events were compared to the results of the baseline sampling event.
- A proposed modification to the Site Wide Annual Overburden Ground Water Sampling Program was submitted to the NJDEP on June 24, 2020, based on current site conditions and the installation of additional ground water hydraulic control systems since the program commenced in 2013. The NJDEP approved the modifications to the program on October 7, 2020.
- April 30, 2021, NJDEP approval of the 2H 2020 SAPR eliminated evaluating individual TICs detected at estimated concentrations above 100 µg/L.
- April 13, 2022, NJDEP approved the removal of 331-MW-2 from the site wide annual program.